

Aviation Week & Space Technology

July 9, 1962

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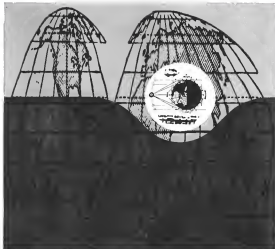
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SOURCE: CTR. NEWS

AEROSPACE CALENDAR

(Continued from page 7)

- Aug. 8-10-1962 Standards Laboratory Conference, National Bureau of Standards Boulder Laboratories, Boulder, Colo.
- Aug. 10-11-1962 National Specialists Meeting, Mrs. M. M. Mackay, Competition Chicago, Illinois, North, Wash.
- Aug. 11-1962 4-Week World Practicing Championship, Miss Susan Spenser National Aerobics Team, Pasadena Club of America
- Aug. 11-1962-Power Energy Conference, American Institute of Electrical Engineers, Fairmont Hotel, New York City
- Aug. 13-1962-Seventh Symposium on Satellite Methods and Space Technology, U. S. Air Force Academy, Colorado Springs, Colo. Sponsors: USAF, Aerospace Corp.
- Aug. 14-1962-Cognitive Engineering Conference, University of California at Los Angeles, Los Angeles, Calif.
- Aug. 14-15-1962-International Conference on Precision Electromagnetic Measurements, Boulder Laboratories, National Bureau of Standards, Boulder, Colo.
- Aug. 14-17-1962-Nuclear Propulsion Conference, Monterey, Calif. Joint Meeting Institute of the Aerospace Sciences, American Nuclear Society, American Nuclear Society (Continued)
- Aug. 14-17-1962-Third International Electronic Circuit Packaging Symposium, University of Colorado, Boulder, Colo.
- Aug. 15-1962-Laboratory Facilities Laboratory Flying Corps and Associates of the French Foreign Legion, 1st National Air Show, North Creek, N.Y.
- Aug. 15-1962-Annual Meeting and Conference, American Operations Council, Powers Ranch Hotel, Honolulu, Hawaii
- Aug. 20-1962-International Symposium, Precision Technology, Philadelphia, Pa. Sponsors: Philadelphia Manufacturers Assn., SAE, IEEE, AIAA, Los Angeles, Calif.
- Aug. 21-24-1962-Wireless Electronics Show and Conference, Institute of Radio Engineers, Los Angeles, Calif.
- Aug. 21-24-1962-International Symposium on Far Infrared Spectroscopy, Sheraton City Center Hotel, Cincinnati, Ohio. Sponsors: Materials Council, Aeronautical Systems Division, Air Force Systems Command
- Aug. 21-24-1962-14th-15th, Institute of Radio Engineers, North Creek, N.Y.
- Aug. 21-24-1962-Quarterly Regional Meeting, American Institute of Aeronautics and Astronautics, West Hotel, Anaheim, Calif.
- Aug. 21-24-1962-Conference on Thin Film, Colorado School of Mines, Golden, Colo. Sponsors: Solid State Electronics Laboratory, University of Denver Research Institute
- Aug. 21-24-1962-Technical Conference on Advanced Electronic Materials, Room 100, Fairmont Hotel, Philadelphia, Pa.
- Aug. 21-24-1962-1st-Third International Conference, International Council of the Aerospace Sciences, New Orleans, La., Stockholm, Sweden
- Aug. 27-29-1962-1-Second International Conference, International Federation of Technical Sciences, Pasadena, Calif.
- Aug. 29-30-1962-Fourth Conference on Materials of Electronic Equipment, Electronic Industries Assn. (in cooperation

with Department of Defense), University of Colorado, Boulder, Colo.

Sept. 1-7-1962-National Advanced Technology Management Conference, Institute of Radio Engineers, Seattle, Wash.

Sept. 1-7-1962-International Symposium on Information Theory, Institute of Radio Engineers, Brussels, Belgium

Sept. 10-1962-Hungary Display and Exhibit, Society of Radio Engineers, Communications, London, England

Sept. 14-1962-National Advanced Technology Management Conference, Dymally House, Seattle, Wash. The grounds, Wash. Sponsors: University of Washington, various engineering groups and technologically oriented business firms

Sept. 17-1962-Symposium on Measurement of

Thermal Radiation Properties of Solids, Brower House, Dayton, Ohio. Sponsors: Aeronautical Systems Division (ASD), National Bureau of Standards (NBS), Sept. 18-19-1962-Fourth National Conference on Applied Microscopy, American Microscopical Society, Elmsford, N.Y.

Sept. 18-19-1962-Annual General Meeting, International Air Transport Assn., Dallas, Texas

Sept. 18-19-1962-Annual Engineering Management Conference (AEM), Hotel Rensselaer, New Orleans, La.

Sept. 17-19-1962-1st-2nd-3rd Air Cautions, Vols. Meeting, Institute of the Aerospace Sciences, Sheraton Hotel, Washington

Sept. 18-19-1962-National Convention & Arranger, Pasadena Air Force Assn., Los Angeles, Calif.



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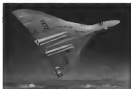
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The New Arsenal Concept

For some years we have been warning the aerospace industry of a trend by the government to squeeze all vestigial of the private enterprise system from the defense business and turn it into a vast federal arsenal. Until recently only a few leaders of the industry have shared our concern over this trend. Now there are signs of a belated awakening on the part of top aerospace managers as how far they have already been driven in this direction and how little of the responsibilities of corporate management a staff left in their hands by their government customers.

But even the participants in the recent Aerospace Industries Board of Governors meeting at Williamsburg, Va., and the Air Force Systems Command conference at Monterey, Calif., will be shocked by the new plans for defense contractors being hatched by the Kennedy Administration to control industry executive salaries and establish new government research centers to take over this activity from private enterprise. These plans have been sketchily outlined by U. S. Budget Bureau Director David Bell (see p. 18). Some industry commentators will continue their shrillness on these issues, hopeful that the proposals outlined by Mr. Bell are somewhat vague at this particular time. However, the extent they express in clear fact to reduce the corporate leadership of the aerospace industry to a federal civil service where salary and second to transfer the vital function of research and development from industry to government research institutions. Even the presidents of government sponsored "non-profit" corporations such as Xerox (July 1960) and Aerospace (July 1960) might be shocked by Mr. Bell's proposal to appoint all defense executive salaries under a \$15,000 ceiling. And if Mr. Bell's proposals sound a little vague at this point, they are certainly explicit as to the Kennedy Administration's determination to create this new federal arsenal.

Much of the preparation for this final assault on the aerospace industry already had been accomplished during the Eisenhower Administration, and it was this distinguished general who first focused the public spotlight on what he regarded as a dangerous alliance between the defense industry and the military establishment in war during that period that the congressional hearings began to paint a bold and unflinching picture of executive profits and behavior of questionable propriety in the defense industry, and few industry leaders even bothered to raise their voices in rebuttal. It was during this period that many corporate presidents signed away many of their management prerogatives in specific contracts and one cynical Defense Department civilian remarked that they would sign their own death warrants if it was labeled a billion dollar contract.

These events in corporate management were widely viewed and some of them looked innocent enough at the time. Only in retrospect have such practices as being unable to transfer executives permitted from one possible project to another without specific government customer approval, and the requirement of detailed re-

porting to the government customer on internal corporate affairs been revealed as central elements of the whole developing arsenal pattern.

Most of the industry has now belatedly recognized these pitfalls and the totem was sounded loudly at Williamsburg and Monterey. But it is a moot point just what can be done to roll back the tide at this late date. The aerospace industry now feels itself almost too hopelessly enmeshed in its contractual alliance with its government customers even to extricate itself sufficiently to regain necessary freedom of action.

If the fate of two industry leaders and their corporate organizations were all that were at stake, this would hardly be an issue of vital national importance. What is really at stake is the future defense posture of the nation and the allies that are dependent on our technology. The arsenal concept failed miserably the test imposed by even the comparatively simple technology of World War II-type weapons such as subsonic aircraft, tanks and heavy artillery. In the complex technologies of supersonic aircraft, intercontinental ballistic missiles and space systems, the arsenal system cannot possibly succeed either as a manager of these technologies or as a producer of the weapons they spawn.

These new technologies have created many management problems as both sides of the fence—in government and industry. The traditional government procedures for defense procurement are now obsolete for acquiring rapidly increasing quantities of weapons and facilities for developing supersonic aircraft, ICBMs, and space reconnaissance systems. What is badly needed is a complete reorganization of the government industry relationship in these new technologies and the development of a new method of doing business in their environment. This type of defense business needs a far different set of ground rules, incentives and restraints than the passive business of having housekeeping supplies.

Most of the critical recommendations of the defense business in recent years have been recommended on small segments of the problem. Too often they have been suggested only to confirm preexisting prejudices. The few attempts to tackle the whole problem and make better new laws and management regulations as modern as the technologies they must handle have failed when this program lost heart before the tremendous complexities of the problem. Yet this task must be done and done soon.

But it cannot be done as long as the government appoints executives with a positive, hostile spirit aimed at usurping the proper functions of private corporate management and creative technology. Nor can it be done unless the aerospace industry assumes a more responsible and aggressive attitude in defending its rights and discharging its obligations, not only to its government agency customers but in the trapping nature of the republic who are the real purchasers of defense hardware.

—Robert Hottel



...to survive in space: the moon and a Librascope computer

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Large Solids Debate

Air Force intention of concentrating on 120-in. solid rockets at the expense of the 156 and 240-in. version has put the service on a collision course with several members of the House space committee.

Rep. David King of Utah, one of the committee members who have been pressing for heavy emphasis on large solids, declares that Air Force intention to do this is a breach of faith with Congress. Rep. King will meet with Committee Chairman George Miller this week to press for special hearings to air the issue.

Chairman Victor Arnsperg of the House space research and development subcommittee, drawing leverage on the National Aeronautics and Space Administration's Fiscal 1964 budget, repeated efforts to withdraw more money than the agency requested for large solids. Rep. Arnsperg and NASA and Air Force officials had reached here their solid development processes were adequately funded.

Figures supplied Rep. Arnsperg at that time showed the Air Force spending \$38 million on the 156-in. motor and \$20 million on the 240-in. motor in Fiscal 1963. But Rep. King and high level Pentagon officials have conferred for fear that most of that money will go into 120-in. version. Rep. Arnsperg is now aggressive in special hearings.

Harold Brown, Defense director of research and engineering, recently told the Senate space committee that large solids had limited military value (AW June 25, p. 10).

Flight Engineers' Drive

Flight Engineers International Assn. is conducting a letter-writing campaign to hopes of persuading of AFL-CIO international affiliates to join the campaign fight against legislation to require compulsory arbitration of airline labor disputes.

Chairman Mike Monroney of the Senate aviation subcommittee plans to introduce a bill soon designed to prevent such type of strikes as the FEIA wished that shut down Eastern. In their letter to airline union leaders, the engineers stress that compulsory arbitration would set a precedent for government control over all labor unions, not just those within the airline industry.

Sen. Monroney's idea is to skirt the bill to jurisdictional disputes within the airline industry. A presidential fact-finding board would decide terms of settlement. The parties to the dispute could appeal the decision to the courts but could not strike. Sen. Monroney is seeking both Republican and Democratic responses of the aviation before introducing it.

Defense Department's detailed report showing geographically where military dollars are being spent (AW June 25, p. 3D) has put some members of Congress on the spot. Lawmakers from states receiving comparatively few defense contracts are questioning their lobbying efforts. Sen. Robert Ellsworth, who lists his state of Minnesota often has been ignored in research contracts, is demanding a monthly report of defense contract awards broken down by area.

MMRBM Future Dims

Study contracts for the program definition phase of the mobile medium-range ballistic missile possibly will not be awarded for at least another three weeks. The contracts originally were expected to be let last week (AW June 25, p. 2B). Also, Pentagon concerns move threaten to restrict the scope of MMRBM studies.

Air Force hoped to have some time on one study considered for each of the MMRBM's six independent. But now Defense leaders plan to leave studies to 10 at the most, and possibly only seven. Future of the study is clouded further by the continued lack of enthusiasm. West European leaders of North Atlantic Treaty Organization nations are showing toward the weapon (AW June 25, p. 9F).

U. S. Information Agency destroyed 10,000 copies of a pamphlet on U. S. space activities because they contained references to the Mideast and Sorensen projects in violation of the Pentagon's new space secrecy policy. (AW May 21, p. 20).

Project Snapshot

Launch date for the thermoelectric source power system for space-part of Project Snapshot has slipped from Fiscal 1964 to Fiscal 1965 because of trouble with the thermoelectric converter. The other power system to be tested is the Atomic Energy Commission's Farnsworth project and a static thermoelectric power converter and is slated to be launched only in Fiscal 1964.

Some scientists and industrialists showed unfavorably toward the use of the term "spacecraft corporation" during the recent National Electronics Conference. Dr. Ivan Gettings, president of the non-profit Aerospace Corp., used the term "public trust not profit" while E. V. Higgins, Westinghouse vice president who heads the National Security Industrial Assn., said "quasi-public corporation."

—Washington Staff

U.S. Considers Industry Salary Control

Budget director says indirect restriction of wages is under study in effort to reduce defense, space costs.

By George C. Wilson

Washington—Kennedy Administration, in its review of federal research policies, is considering indirect salary controls among several actions which would make basic changes in the relationship between the government and aerospace industry.

Central question is how to get maximum value from the billions the U.S. government spends on research and development, especially in the defense and space fields. The House Military Operations Subcommittee, headed by Rep. Carl Albert (D-Calif.), intends to spend the rest of the congressional session on the question.

Although research policy changes still are in the study stage, testimony before the subcommittee illustrates that President Kennedy is welcoming industry new concepts. "There are some of them," industry plans committee Director David E. Bell of the Budget Bureau said "contractors should be reimbursed only for reasonable competition costs" as less than are such "budget controls" as "adequate competitive bidding or other economic incentives."

However, Bell said he was not recommending direct salary controls on industry. Instead, the Administration hopes to find indirect ways to control salaries. He said considering more competitive bids on research contracts and relying more heavily on incentive-type contracts would help drive down total costs, including salaries. Bell said another possibility was to require that research contractors of federal agencies to approve cost-type contracts covering individual salaries over \$15,000.

Complex Problem

The nationalized research industry faces "a complex and difficult problem which we expect will require a considerable effort," a report submitted to Congress by the subcommittee said. "Unless we have some kind of system under which the private salaries financed by the government are reasonably related to each other," Bell said, "we are automatically setting up our own competition in a way as to draw all the best people out of the government."

Government research institutes Bell said the Kennedy Administration takes as axiomatic the relationship research institutes patterned after private, non-profit corporations. He said a bill to do this already is being drafted. But he felt, at least for the rest of this congressional session, it ought to remain a study document.

Instead for such government activities as the conversion of creative per-

sonnel may stay with the government only if they have the kind of non-bureaucratic atmosphere found in some industry situations. Bell said creative personnel deserve to be paid with considerable difference.

Cost avoidance. Kennedy Administration is trying to develop anti-inflation policies among the armed services and government agencies regarding allowable costs on competitive contracts. "We are about to get from the technology staff to the policy-making staff," Bell told the subcommittee.

Industry Viewpoint

Edgar Malt, treasurer of Arthur D. Little, Inc. of Cambridge, Mass., headed an industry committee which studied the questions raised by President Kennedy July 31, 1961, in a letter requesting the Budget Bureau to consider tighter federal research policies. Malt, in reviewing his group's study, told the subcommittee there already is competition for federal research contracts. He also contended the government should not disrupt existing relationships with industry by trying to bring down the work of non-profit research firms.

Minimum Tests

Operational minimums of complete USAF Minimums weapon system has been demonstrated at Vandenberg AFB and Boeing Seattle plant.

The minimum tests were the first tests that missile, launch tube and control system have been tested in an integrated system. The missile test run ended at Vandenberg will be used to launch a few months down the Pacific Missile Range is the first test shot at a minimum. Minimums are complete operational facilities. Cape Canaveral Range has made the missile independently of operational launch facilities and support equipment.

Because of competition for research contracts, "the control of costs by private organizations is not dependent upon their willingness to do so," Malt said. "It depends on the quality of the government is now obtaining resources from many organizations." As a result, there is competition both in price and concept and in pricing or cost.

The area of this continuing competition of both concept and cost is to keep the organization efficient and productive in industry and also in costing. Because government agencies in comparison are likely to be quoted competitive companies, both in its concept and in its cost, and in any event, do not feel the continuing impact of cost control imposed through competition and also find a balance down to keep out of low income and then show a profit margin.

As for establishing government research activities, Malt said "many of the competitive salaries and retaining retaining research within government agencies can be an answer. The government, however, must not be required for the person individual acquisitions which it is difficult for the government to provide and has been close in actual comparison of government agencies.

They create personnel of the type required for difficult government assignments are so scarce that it is most desirable that these individuals be kept where their effectiveness is enhanced by the presence of all possible controlling factors, rather than by moving such personnel from their current environment through being sent into specially created government agencies, which thus is leaving significant gaps at new centers or institutes of government. Moreover in such agencies the work will not find the cost saving effect and stimulation of competition.

Malt said further that creating the steady state creative industry research activities to the government would result the transformation of ideas into marketable products a technique already perfected by contractors.

Employer's Views

William H. Ryan, representing the Government Employees Council, AFL-CIO, said the federal government should expand its research capability and "it will have a better way of financing the research and development performed by contractors. Another advantage of expanded government capability, Ryan said, would be to move the profit motive from the defense business. "As long as we have profit motive," he said, "there will always be the danger of government inefficiency by



Telstar Communications Satellite Mated to Delta Booster

Tables active active communications satellite, developed by American Telephone and Telegraph Co., is mated to the final stage of the Delta launch vehicle by Douglas Aircraft Co. Industries at Cape Canaveral, Fla. The 170 lb experimental satellite is scheduled to be launched this week by NASA in AT&T order terms of an agreement reached in 1961 (AW Aug. 1, p. 34).

private and irresponsible individuals and organizations."

Buildup for the subcommittee hearing in the Budget Bureau report entitled "Government Contracting for Research and Development." The report was submitted to President Kennedy Aug. 30 (AW May 3, p. 31). It concluded: "The present high degree of interdependence and collaboration between government and private institutions is desirable."

The Budget Bureau report said this leaves the question of "what should the government do to help the partnership work better in the public interest and with maximum effectiveness and economy."

Tendency to date indicates industry would look upon such things as salary controls and government research activities as a disruption, rather than as an improvement, of the present government-industry partnership. The subcommittee said it was making judgment until after its extensive hearings are completed.

The fact that the Kennedy Administration is planning to establish federal research institutes through legislation rather than executive order, indicates that Congress will have a chance to approve or disapprove this basic change in research policy.

House Unit Tells NASA to Weigh Continuation of Centaur Program

By David H. Hollman

Washington—Whether the U.S. should continue to invest in Atlas-Centaur development after spending \$150 million in the previous National Aeronautics and Space Administration has been told to examine this month by the House Committee on Science and Astronautics.

In a highly critical report released last week, the committee stressed both NASA and General Dynamics Atlas-Centaur, the prime contractor, of offloading work and ineffective management by the program. Changing fiscal controls the industry-led launch vehicle which now was to launch five Atlas U.S. space programs—has been a "widespread effort" during its course between the contractors' spending, the committee said.

NASA should operate the program to determine whether it will "provide a good investment" for U.S. technical and business interests. The committee requested a thorough report within 10 days, accompanied by a list

recommendations as to whether Centaur should be awarded a DSN position, the nation's largest, to place it on a new work program. Apollo and Saturn.

Close, controlled supervision should be maintained over Centaur by NASA, if it decides to continue the development of the vehicle. Highest standards of quality control should also be demanded of contractors and subcontractors. It has been recommended "the entire program should be reviewed by the committee, that NASA's Marshall Space Flight Center has been engaged in a 'porting out' of its policies into the government's Centaur program."

General Accounting Office should investigate development of Centaur to determine whether associated costs have exceeded adequate protection to the government. In addition, the practice of assigning military officers on short-term duty to NASA as project directors or managers should come as soon as possible to prevent the continuation of ineffectual space programs.

Launch of the first Centaur, originally scheduled for January, 1963, was postponed May 6. Following what ap-

ness. Defense Department is right in encouraging legislation.

• **Category 7**, those which Systems Command can put into effect itself. Action in some of these recommendations, standardization and uniformity of reporting requirements (AW June 5, p. 78). USAF sources note has already begun.

No one specific procedure will be followed in working to translate the recommendations into action. However, the recommendations involving steps to higher levels of command should not be regarded as solely Systems Command alone but within the control of the commander of the Wiesbaden wing of the Aerospace Industries Association and the report by David E. Bell of the Budget Bureau (AW May 7, p. 78). Not all the Systems recommendations have been available to contractors for management in Systems Command. Decision on several final approval by last week.

Among the key conclusions and recommendations regarding first system:

- **USAF and DOD** should consider leaving top-level management of program details. For purposes of delegating responsibility and control, not new relieving time, documentation, sense of policy control, top-level management, operating management, reduced planning, technical direction and program management should be separated.

- **Motivating** contracting procedures should be adopted by Systems Command to insure retention to reduce the number of bidders in competition and reduce proposal costs. This procedure will be reinforced by a technical proposal-by judgment on its own merits—by one deadline and follow-up with the cost portion three or four weeks after. A more selective approach in selecting bidders also is proposed.

- **Wingbeat** between request to technical staff, management staff, technical and past performance should be included by Systems Command in the report by Systems Command on the program.

- **Cost sharing** is not a general USAF objective and will be a function of policy on this subject by Systems Command may be in order.

- **Industry compliance** that implements train of Armed Services Procurement Regulations and Air Force Procurement Instructions made to become more restrictive than intended by the regulations were recognized and a review of all activities of such industries was necessary.

- **Standardization** of government regulations by DOD, the National Aero Services and Space Administration and the Atomic Energy Commission was urged, with a recommendation that Systems Command make strong progress in DOD along these lines.

- **Reporting and data requirements** now

discussed in various recommendations. In essence, these recommendations indicate compliance of records, but increased USAF's confidence that many also are required by industry internally and should not be necessary to high cost in industry. One recommendation proposed that industry join with Systems Command in formulation of joint data requirements to reduce them to absolute minimum. The assurance of USAF's responsibility for compliance of programs, and resultant need for reporting in general was made but emphasis on reduction was accepted in main plans and challenges to act reports.

Super Caravelle Management Plan Triggered Resignation of Hereil

By Cecil Rowland

Paris-French cabinet is considering possibly increasing 15 potential increases in the presidency of state-owned Sud Aviation following the surprise resignation of Georges Hereil, 51, who had guided the major airborne manufacturer since its postwar reorganization in 1946. Leading contender for the post outside Hereil is General Manager Henri Ziegler and Sud General Director Louis Guisot.

Publicly announced reason for Hereil's letter of resignation dated June 22 is his leaving opportunity to be planned management structure for the project joint French-British supersonic transport venture.

Sources close to Hereil say, however, that, while this was a determining factor, he has considered stepping down for at least the past year.

Industry officials in both France and Britain say they do not expect the resignation to affect the outcome of the joint developed program.

Hereil, who has considerable business and financial interests outside Sud, reportedly has felt that, with the success of the medium-range Caravelle transport program, which he managed, he could turn his efforts to other fields, although he probably would have remained if the supersonic management program had been formed along his lines. The Caravelle, with well over 150 delivered or on order, is approaching its planned six-year production peak.

In casual conversations with the English, Hereil had stated that he had the program at least through 1965 when Sud flight of the prototype aircraft is tentatively scheduled. The French of Sud say, an agreement along these lines had been reached between Sud and British Aircraft Corp., but that the pact was subsequently delayed during discussions at a government-to-government level. Hereil's sources, while agreeing

that Hereil initially had insisted upon a five-year tenure, stated that he appeared to be "perfectly happy" when the government negotiators, at Hereil's request, agreed upon a contract for a three-year extension with the French executive covering the first term.

While the supersonic program is being largely upon Sud's Model 3-2 Super Caravelle development, the British have insisted upon a number of design changes and want to see the chairmanship shared by the George Edwards managing director of British Aircraft Corp. particularly during the final stages.

To accomplish this, British negotiators had threatened to withhold its government's estimated \$190 million share of the \$280 million program unless the two-year plan was agreed upon within the first term.

Agreement on principle was reached this spring (AW Apr. 2, p. 20), but the British government has yet to actually allocate any funds to the project. The French then has been left with a bill for detailed design study work.

As now envisioned, the low-speed aircraft will be built in two configurations—short to medium range aircraft for the French and a transatlantic version for the British. Possibilities under consideration include the British Sudley Olympus 593 and a Rolls-Royce design now under development.

Should the British pull out, however, the French have said they will seek either Pratt & Whitney or General Electric in the U.S. for a solution. One present worry, other than the usual boom effect over inhaled terms, is the anticipated high price level on the ground which might preclude the aircraft's use at a number of airports.

Hereil, as president of a major state-owned firm, can set a firm departure date only after his resignation has been accepted by the French cabinet and a replacement appointed to succeed him.



HSS-2 Modified for Presidential Mission



Deliveries of eight Sikorsky HSS-22 two-blade helicopters for presidential use from Marine Corps ships and four Army are under way. The aircraft have the basic exterior configuration of the HSS-2 with the exception of the cockpit area mounted in the right position. A "picture window" is provided on the left side of the rotor hub. Extensive communications equipment is installed, in the maximum emergency situation. The cockpit area is an electronic direction display. Standard Army and Marine markings are followed, except a high blue flash is used rather than the standard tail paint. Presidential seal is affixed to the door at a special mounting when the President is aboard.



FAA Study Blames Control Delays For \$36-Million Fiscal 1961 Loss

Washington—First comprehensive study of arrival and departure delays caused by bottlenecks in the air traffic control system shows that they cost U.S. aircraft operations \$36 million in fiscal 1961. During the year, the United States scheduled airline industry carried only 56,162,308.

It is probable that similar or greater delays were experienced throughout the last calendar year. If so, ATC guaranteed problems could be held responsible for almost the entire net cost of \$16,887,000 suffered by the carrier in calendar 1961.

This conclusion is drawn from data collected by Federal Aviation Agency's Air Traffic Service and analyzed last week in the form of a staff study on "Elapsed Time and Cost in Air Traffic Terminal, FY 1961."

After analyzing instrument flight rule (IFR) flight plan filed for 1957 de-

partures from 1,178 U.S. airports in fiscal 1961, FAA reached these significant conclusions:

- **Excessive elapsed time**—which FAA defines as the difference between a pilot's forecast elapsed time and his actual departure time, less 5 min. for normal operations contingencies—cost \$16.9 million. Gross elapsed time cost \$24.5 million.

- **Top 245 airports** accounted for 83.8% of total elapsed time recorded based on IFR peak day departures. Of this, 40.9% was attributable to 18 high density airports. Assuming that departure and arrival delays were equal, FAA estimated that 1,533,890 hours were lost due to terminal obstructions.

- **Operational data** with which to pinpoint the cause of delay is lacking. In order to make data available next month, FAA will conduct an instrument flight rule (IFR) flight plan filed for 1957 de-

partures from most delays could be reported. Thus the agency would be armed with enough information to take corrective action.

To arrive at the \$36 million FAA said was attributable to ATC, the agency relied on an earlier study completed by the Air Transport Association in 1957. Covering 24 U.S. airports, that indicated that ATC's contribution to total delay ranged from zero to 35%. An average figure, it said, was 10%, and the same ratio was adopted by FAA.

Longest delays alone in fiscal 1961 were reported at New York International Airport, which experienced a total of 7,562 min. on its peak IFR day.

In the agency's ranking, 18th was followed by Washington National, Los Angeles, Newark, Los Angeles, Atlanta, Pittsburgh, Boston, Cleveland, Miami, St. Louis and San Francisco.

Although San Francisco ranked 12th in total delay, it ranked third in peak day departures, indicating that traffic peaks and delay rates are not always proportional.

Apollo to Use Lunar Orbit Rendezvous

By David H. Hoffman

Washington—National Aeronautics and Space Administration has decided to make the success of Project Apollo on the technique of rendezvous in lunar orbit as an attempt to accomplish a manned lunar landing before the Soviet Union.

This basic decision (AW July 2, p. 106) which NASA was expected to announce last week, virtually rules out parallel development of the booster, stages and modules in which have been planned by other space agencies or such other agencies as exist at the time. But lunar orbit rendezvous, NASA believes, may show up to two years from the Apollo time-table and cut 10 to 15% into the cost of these two techniques.

One result of the decision is that NASA intends to conduct an intensive study of whether an unmanned lunar logistics vehicle must be prepositioned on the moon to furnish the astronauts with equipment. It is expected to be as to eight weeks before the space agency decides whether to develop such a vehicle, which might carry the oxygen and water necessary to start otherwise can be carried in the manned space craft.

Second Result
A second result of the lunar rendezvous approach is that development of the Nova booster will be deferred for at least two years. Nova, as now conceived, is to be used for space exploration missions beyond Apollo. NASA also has indicated that the vehicle's total thrust will be increased, giving it a lifting capability up to three times greater than that of the Saturn C-5 vehicle slated for Apollo. Early on, NASA envisioned Nova in having about double the lifting capability of C-5.

The agency will request industry to submit design proposals shortly for a "lunar excursion vehicle." This is the big in which two of the three Apollo astronauts are to detach themselves from the mother spacecraft and travel to and from the lunar surface (AW July 2, p. 82).

In the lunar orbit rendezvous version, a three-man module (approximately 15 ft in diameter) will be launched on top of the C-5 launch vehicle. It will include:

- **Command module**, weighing about 6,000 lbs and 12 ft high, to house the Apollo crew.
- **Service module**, weighing 21 tons and 25 ft high, to contain the propellant for air-entrained conversion and earth re-entry.
- **Lunar excursion module**, weighing about 15 tons and 28 ft tall.

First two of these do not represent

fundamental changes in configuration for the Apollo capsule (AW July 2, p. 91). But the last is expected to involve a total re-evaluation of about \$400 million, of which about \$150 million probably will be awarded in contracts to industry.

The astronauts' safety ultimately will depend on the reliability built into that module, which adds 50% to the spacecraft's weight and which must propel itself into and out of a totally hostile environment.

Essentially, the mission profile chosen for Apollo calls for a C-5 to launch the spacecraft directly into a circular lunar orbit around the moon at about 100 miles. Two of the three astronauts on board then would enter the excursion module and execute the lunar landing, leaving one astronaut at the controls of the ship's approach.

In the absence of milestones, up to two days would be spent exploring the lunar surface. When this is completed, the two would re-enter the module and launch it into an elliptical orbit with one of the two astronauts in command and active modules.

Rendezvous would be by one of two techniques (AW July 2, p. 106). If the "hard docking" method is selected by NASA, the big would mechanically couple to an orbiter on the Apollo capsule. Pilots would enter the spacecraft through that dock and the excursion module then would be jettisoned.

If "soft docking" is employed, the big would be attached to the capsule by a bag would be thrown from one to the other. Pilots of the big would use this line to pull themselves to the mother spacecraft, attaching it through the air lock.

With the bag attached, the entire module, with 20,000 lb of thrust available, would take the command module out of lunar orbit on a trajectory aimed at earth. First in making the re-entry module orbit would be the service module.

No major changes are now contemplated in the Saturn C-5 launch vehicle slated for the mission. Its Boeing S-IC booster stage will consist of five F4H stage #3 engines developing a total of

7.5 million lb thrust. Its second stage will consist of five Rocketdyne J2 engines each developing 100,000 lb thrust. S-IB third stage will be a single F5 engine.

When mated with the spacecraft, the launch vehicle will be 135 ft high and weigh about 6 million lb.

Turning all of these intricate spaceflight will begin in the mid-1960s, using the Saturn C-IB launch vehicle. Although required maneuvers probably will be performed while the spacecraft is in earth orbit, this does not mean that NASA can skip from the lunar orbit rendezvous technique to earth orbit without taking a huge time penalty. This is because different looking and touchdown modules and systems are required by the latter mission, even though the approach and module are interchangeable between the two.

The lunar orbit rendezvous technique was conceived by John C. Houbolt, associate chief of dynamic flight studies at NASA's Langley Research Center (AW Nov. 5, 1961, p. 50). Within NASA, it was the support of Manned Spacecraft Center, while Marshall Space Flight Center issued launch and launch in earth orbit.

Lunar Stunts

Decision to use the lunar orbit method also might cut in half the number of launch vehicles to be built initially at Cape Canaveral, Fla., in support of the lunar landing goal. Earth-orbit approach envisioned four identical Saturn C-5 stands, but the lunar technique—requiring but one launch vehicle—could be executed with two stands, and the potential for a second and for a backup booster and spacecraft. Four stands undoubtedly will be required as the program develops beyond the first lunar landing.

NASA also is understood to have received a recommendation from its new Launch Operations Center that the crawler version of the transporter-launcher (AW July 2, p. 115) be used in the operation of the Saturn C-5 system.

Estimated Annual Gross Cost of Terminal Area Delay for 83.8% of the Airports

Airports with 100 or More Minutes of Adjusted Report Time	Category of Aircraft					Totals
	Turbine Engines		Piston Engines			
	Jet	Turboprop	4-Engine	3-Engine	1-Engine	
Peak Day AET (Minutes)	33,374	14,442	49,949	59,536	2,629	156,830
Average Day AET (Minutes)	21,550	3,765	26,636	33,819	2,705	99,561
Annual Minutes	7,646,420	3,199,225	9,722,142	13,101,675	804,625	34,657,285
Annual Hours	121,157	53,320	162,034	218,528	13,410	503,438
AET (Dep. and Arr.)	262,314	106,440	324,072	436,732	26,828	1,156,576
Average Hourly Operating Cost	\$900	\$500	\$475	\$180	\$40	
Annual Cost AET	\$726,082,600	\$53,320,000	\$152,894,290	\$76,809,960	\$1,073,120	\$123,049,840

Estimated Annual Cost of Excessive Elapsed Time for 245 Airports

345 Airports with 100 or More Minutes of Adjusted Elapsed Time	Category of Aircraft					Totals
	Turbine Engines		Piston Engines			
	Jet	Prop	4-Engine	3-Engine	1-Engine	
IFR Peak Day AET (Minutes)	23,430	9,474	21,725	36,320	1,556	101,671
Average Day AET (Minutes)	14,999	5,742	22,018	27,018	1,158	62,494
Annual Minutes	\$12,000	2,095,320	6,354,285	8,034,576	410,625	22,880,390
Annual Hours	68,893	34,931	105,903	133,943	6,844	346,006
AET, Dep. & Arr. (Hours)	172,764	69,282	211,810	287,216	13,648	756,012
Aves. Operating Cost/Hr	\$900	\$500	\$475	\$180	\$40	
Annual Cost AET	\$125,486,000	\$34,901,000	\$100,610,000	\$48,219,000	\$547,000	\$329,746,000

OSO-1 Transmissions Resume After Month

Washington—Dilling Space Observatory 1, which recently resumed transmitting on May 12, resumed sending live information on June 24, the space agency said last week.

OSO-1, a small spacecraft, apparently transmitted an error signal that caused the satellite's spin rate to increase. At 10 rpm, OSO-1's spin rate could not spin its solar cells at the rate without depressing the satellite's battery charge, and an automatic cutoff prevented this from happening.

However, according to National Aeronautics and Space Administration, after being freed by the earth's magnetic field, OSO-1's spin rate, allowing its scientific instruments to point towards the sun. The magnetic field may accomplish the reverse and cause spin rate to increase to a point where it is impossible, NASA said.

Penalty Cuts No-Shows, But Adds Costs

Airlines question continuance of plan despite successes because of problems and complaints it produces.

By James R. Ashlock

New York—Airlines experience in the last two months' operation of the "no-show" penalty program indicates a reduction of 25-45% in no-shows, but serious problems threaten the program's continuance after its six-month trial.

Based on the reduction of no-shows and unscheduled reservations, most airlines feel tentatively that the program has merit. However, uneasiness is expressed over added costs of administering the program, difficulty in collecting fees, increased passenger complaints and dropouts at ticket counters.

Airlines' uneasiness on these problems were anticipated because the public would not support the program as an administrative cost device, in getting about whether the public will come to realize the intended purpose of the program, specifically the assurance of fare reservations, reduction of overloads and fairer allocation of available seats.

Two of the major reasons airlines feel the program has added efficiency to reservations and ticket counter personnel. Reducing the no-show also has a benefit to oversold passengers, staffs are more careful in recording reservations properly, the carrier says.

Majority of carriers hold that the no-show plan cannot be fully effective until there is a universal advance procedure that will put a penalty ticket in the carrier's hand at the time of ticket distribution. Seven airlines, with aggregate revenue \$385,000 in fares to 10,000 people who were no-shows, but had not paid for tickets in advance. Collections were disappointing. The major one reporting only one out of 30 paying the fee.

Carrier spokesmen say they do not favor penalties for reducing the no-show plan. It is "a lot" money, they say, and it must be on only lefty carrier costs of administering the program. They say, however, that they are prepared to enforce program penalties on tickets which probably meet expenses from certain carriers, especially those with large Air Travel Plans in long-standing commercial contracts.

Some carriers express dissatisfaction with Civil Aeronautics Board's refusal to assist the airlines in developing a stronger enforcement of no-show penalties. CAB holds that enforcement is the carrier's responsibility, and airlines say as whatever means considered best for the only present recourse is through standard legal procedure, and carriers are then in no position of imposing a heavier or collector to a carrier that is in a

poor position to produce an asset that a \$10 fee.

A spokesman for one carrier and the CAB "acknowledged" the airlines' interest in adopting the no-show plan by making it a condition on future approval of fare increases. Another blamed the CAB's refusal to help in the enforcement to the fact that the airlines are not sure they can enforce the plan.

In spite of the enforcement problems, the airline spokesmen still maintain an optimistic attitude toward the principle of the program.

"We had nothing better, and now we have this," one spokesman said. "At least we now have something to work with."

The no-show plan has stimulated thought about alternate programs, as carriers begin to start would discontinue the penalty program. As an example, an executive of one of the Big Five airlines, who carries a plan that would make a reservation an contract item, the fee that would be payable, exceptable in view of the trend toward no-reservation service, such as that on Eastern's Air Bus and Air Shuttle scheduled service.

Under such a plan, a traveler would pay the airline fare, then purchase a "reserved seat coupon." This would entitle him to a firm reservation. With out the coupon, he would take the chance of a seat being available. The spokesman suggests that such a plan be restricted to coach class travelers, with first class passengers getting reservations as an intrinsic benefit of the higher fare.

Two airlines are open under such a plan, he said. The reserved seat coupon could be a deposit, refundable if the passenger shows up for the flight and forfeitable if he is a no-show. Or, it could be a non-refundable fee for the assurance of a seat on a

Other feel that the earlier no-show plan, discontinued in December, 1958, had benefits over the existing one, and that perhaps some of its provisions should be resurrected. Disregarding the "Three-Pass No-Show Control Plan," it was enacted in three steps beginning in September, 1956.

In continued requirements for early ticket payment and penalty, reasonable use of reservations and a no-show penalty of \$3. This program died for lack of continuous full carrier support. "Except for an adequate no-show penalty," that program had most of the provisions the present one lacks for effectiveness, one Big Five airline executive said. "It would have worked out had it received buy enough for the public to become more accustomed to it."

Ray Beards, senior vice president of Beards and chairman of the joint airline committee which drew up the present plan, believes the public is gradually accepting the current program.

"We believe the traveling public will come to appreciate the difficulty caused by making a reservation and then failing to follow the intent of their intention to not use it," Beards said. "Once that realization is attained, the plan will become even more effective."

Beards and himself attained a 45% reduction in no-shows during the plan's first 45 days. The airline has received 361 letters of complaint, a small percentage considering over three million 1959-1960 passengers in May alone, Beards said. About 25% of those letters held for no-show penalties have paid, he said.

"I fully realized at the time the program was being proposed that some carriers had reservations about it," Beards said. "But I believe that some of those are now becoming convinced it was for the better."

He also said that Beards had experienced no significant increase in administrative expenses as result of the no-show plan.

Other carrier reactions: **American reports 42% reduction** in no-shows, amounting to 20,377 passengers. The carrier says the plan has also strengthened efficiency of its reservations staff. "So far as we're concerned, the no-show plan has been successful," an American spokesman said.

TWA reports 25% no-show reduction. GM 1,600 bills are out, representing \$37,665 in penalties. 19 reported with a percentage of 50%. Part of the reduction, TWA believes, is due to its



Vickers VC.10 Makes First Flight at Weybridge

First Vickers Aircraft VC.10 jet aircraft brought made a British Aircraft Corp. today at Weybridge, England. Aircraft landed at Weybridge. The VC.10, in BOMAC markings, was airborne after a test of 2,100 ft. at a speed of approximately 130 ft. The aircraft is powered by four Rolls-Royce Conway 45 engines developing 31,000 lb. thrust each. It is planned to carry up to 100 passengers. Maximum gross weight for the VC.10 is 290,000 lb. Weight was held to 180,000 lb. for the first flight to allow the aircraft to take off from the 4,500 ft. Weybridge runway. Pilot on first flight was Capt. G. R. Brown, BAC chief test pilot.

own program, began at March, when the agency began making reservations for holdovers before taking interest in the no-show program.

Continental believes the program is helping but feels it is too early to determine accurately how much. Some no-show reduction is credited to efforts to have tickets mailed up 10 days before flight, or as soon before if the reservation is made less than 48 hours before flight. Nucleus Airlines have been made against no-show tickets and 247 offices issued with a low rate of collection. Continental received 34 complaint letters, low compared with a 175,000 monthly passenger volume.

Delta says there has been a reduction of no-shows, but it could not be considered "substantial." The line believes it is too early to condemn the plan, but advocates amendments to ease administrative and enforcement problems.

Eastern feels the program has reduced no-shows, but questions whether there is overall solid administrative cost. Collections on fares have been small. Also, the carrier thinks that it is some ways the program conflicts with other passengers designed for passenger convenience, such as mail tickets.

Northeast expresses reservation to avoid the program in light of mail to show reduction compared with \$34,500 in added administrative costs. The merged telephone call per reservation has lengthened 28 sec. in result of handling reservations with program provisions. GM \$15,100 in fares billed, only \$15,775 has been collected.

National Inland two months' operation is not enough to show definite results on the program, but shows other carrier opinions that the program is weak because of administrative and enforcement difficulties.

Examiner Denies First Application For Third-Level Service Authority

By Ward Wright

Washington—Civil Aeronautics Board examiner has denied the application of H-Pass Airlines to conduct third-level service with light aircraft over low-density routes in a separate area.

Economist Richard A. Wright's ruling is the first on one of the 15 third-level certificate applications on the CAB docket.

Wright also denied the application of Central Airlines to operate a similar service designating parts of H-Pass's proposed routes. Central had stated that it did not think the service was necessary, but if CAB did, Central would be in a better position to operate the route than H-Pass.

The outcome of the H-Pass application was, however, a considerable influence on before third-level certificate cases. Wright said, third-level applicants were that the service is needed to fill the gaps left by local service carriers as they switch to larger aircraft and seek higher density markets.

H-Pass' contention that it could serve smaller communities with mail service better than local service carriers can with their present equipment, is reminiscent of claims made by the local service carrier seeking certificates on the original local service cases, Wright said.

These certificate have not stopped local service carriers from seeking letters of waiver, which mean the issuance of whether authorization of third-level service as a matter of preference to non-

tenure of "fourth-level" service, Wright said.

H-Pass' estimate of 17,440 passengers carried 14 million scheduled miles with total revenue of \$1.7 million for the first full year of operation, is too optimistic, Wright indicated. The estimates were far above the actual traffic carried by Frontier Airlines over several of the same routes in 1958.

The experience of carriers who have used small aircraft as scheduled service and discovered the public prefers the larger, must be considered, Wright said.

Bureau of Economic Regulation's estimate of \$1 million annually for H-Pass appears to be the maximum amount of subsidy needed, he said. There is "possibility" evidence that if H-Pass were authorized the over-all subsidy costs for H-Pass and local service carriers suffering from according to some—could be substantially higher, the examiner said.

In fact, Wright said, H-Pass would be subsidized to carry passengers which the local service carriers had found too costly to transport.

The H-Pass proposal calls for the use of H-Pass aircraft 500K with a route network serving points in the District of Columbia, Nebraska, Kansas and Kansas City, Mo.

It would be VFR service with a flight completion time estimated at 97%. Central's proposal also calls for the Aero Commander 500K but it would operate VFR and IFR. Central estimates flight completion time at 91.4%.

Bill Strengthens Control of Supplementals

Washington—Civil Aeronautics Board during the next few months will draft the changes in the regulation of the airline business by deciding which representative carriers shall be granted operating authority under the competitive bill just passed by Congress.

The Board must make its decision no later than 90 days after the competitive supplemental airlines bill becomes law. All supplemental carriers dealing with operating authority must first apply with the Board within 180 days after the bill is passed.

Assessments of the measure range from labeling it a "death sentence to the supplemental air carrier" to a claim that it will bring order out of the chaos surrounding these operations. Unfortunately, the bill Congress finally passed represents a victory for the trunk carriers and their organization, the Air Transport Union.

The bill also nominates a defendant for Chairman Mike Monroney (D-Ga.) of the Senate aviation committee, who failed to persuade the House that supplemental carriers should be permitted to operate. The bill provides no authority and imposes new restrictions on the supplemental.

Charles E. Lewis, president of the Independent Airlines Assn., in a telegram to President Kennedy last week, and the final bill "disastrously affects all small airlines as carriers. It restricts their operating authority to the point where it is tantamount to a death sentence for these small airlines which represent the majority of the nation's emergency aid and the only link, line out-of-town service."

Declaring the bill "is not in accord" with Administration transportation objectives, Lewis urged President Kennedy to veto the measure and to instruct the Justice Department "to conduct an investigation into the tactics employed in the scheduled air carriers through the ATA is following the bill."

George W. Thompson, president of the National Air Carrier Assn., and the bill would be a death sentence—especially for those supplemental carriers who have made no attempt to comply with the rules and regulations of the CAB. "The legislation will accomplish what the scheduled airlines have been unable to do through the exercise of the free enterprise system. The result will undoubtedly be higher fares to the public."

Len Seybold, ATA vice president of inland affairs, said the measure "should bring order out of the confusion which has resulted for years with respect to the role of supplemental carriers while

avoiding the situation which would have led to the possibility of completely abandoning the scheduled carrier routes by giving them to the supplementals."

There are six major provisions of the final bill.

- Individually-inducted authority. Supplementals will have the authority only for short periods when the CAB determined scheduled carriers could not handle all the passengers. This temporary authority would be granted for 30 days and could be extended twice, making no more than a total period of 90 days. This is the House-passed provision. The Senate-passed bill provided permanent individually-inducted authority. The law provides a two-year adjustment period for supplementals to switch from individually-inducted to charter operations. However, during these two years supplemental carriers could not take in more annual gross revenue from their individually-inducted operations than the average annual gross earned in 1959, 1960 and 1961.

Temporary and such severe restrictions were not justified, since last year the supplementals earned less than 6.5% of the gross domestic air carrier revenue. I. H. Mansfield, sales manager of the Independent Airlines Assn., and these four years were unfair because several of the supplementals currently offering individually-inducted service were not operating during that period.

- Charter definition. Senate bill included all express-paid routes within the definition of charter service. Supplementals were hoping to exploit this situation.

Imperial's Dilemma

Washington—Imperial Airlines, a struggle between the conflicting demands of the Civil Aeronautics Board and Federal Aviation Agency, amounts to a head-on collision with the CAB in an effort to drive out of business.

Imperial said CAB is demanding that the line fly in the last of public security conditions, while the FAA is preventing further operations by refusing to issue Imperial's aircraft operator's certificate.

The supplemental airline said FAA's refusal is "arbitrary, arbitrary, unconscionable and unlawful." FAA suspended the certificate shortly after the Senate passed such which killed 77 passengers. The CAB did not mention this suspension, Imperial said in asking the school to show cause why its certificate of public convenience and necessity should not be lifted for failure to conduct operations.

Imperial plans to go out of business, but wants to salvage its certificate as a corporate asset.

let, choosing this was tremendous potential in managing them from Europe to the U. S. The losses were not the final cause dropped this definition.

• Cargo carriers. Sea-Clear Eagle (D-Calif.) successfully petitioned for language empowering the CAB to let single carrier engage in passenger charter operations. In the past, the Board has granted exemptions for this purpose. The Senate-commerce committee said such broad use of exemption powers was "not only unsafe, but illegal." The Senate House-commerce report contended, declaring such authority should be put on a statutory basis. The conference committee and, however, that "it does not intend that this amendment be interpreted as a directive that the Board should necessarily grant the cargo carrier either any greater or any lesser authority" than the Board granted single charterers. The intention is only to state that the Board act under specific statutory authority and not under a strained interpretation of a provision not contemplated by Congress.

Despite this conference report language, Thompson, the National Air Carrier Assn. interpreted the Eagle amendment as granting foreign air carrier passenger rights "which have been aggressively denied to them by the CAB on several occasions, not being necessary desirable in the public interest." Other supplemental spokesmen said the amendment would create additional competition for the passenger market available to those under the new regulations.

- Fitness standards. CAB under the bill can require supplementals to carry liability insurance, type performance bonds and meet minimum service and financial soundness requirements. The Board without notice can revoke authorizations for 30 days if one of these requirements are not met.

• Civil penalties. CAB can fine an airline and shut supplementals up to \$1,000 a day for violation of Board and FAA rules. ATA has opposed this provision as grounds the board "ought nullify and close the current to death."

The Commerce bill was passed in the House June 25 on a 319-0 vote and passed the Senate the same day on a voice vote. Chairman John Bell Williams (D-Miss.) of the House aviation subcommittee, and the Commerce bill, "which is a shocking, which is a bill which will protect the interest of the flying public."

Sea-Monarchs said the final bill was "a far cry from the one the Senate passed originally, but the bill's advantages lie in the hands of the airlines."



ONE OF THREE IL-38 TUDORPORT AIRCRAFT operated by Malev Hungarian Air Transport is shown at Budapest's Fehérvár Airport.

Malev Plans Near East, Africa Expansion

By Edith Walked

Budapest—Malev Hungarian Air Transport state-owned Hungarian carrier, is planning near eastern routes to the Near East and Africa to complement its goal of becoming a major airline between East and West Europe.

Gradually recovering from the ravages that swept the country during and after World War II, the airline said it is planning to enlarge its fleet of aircraft and hopes to expand its international network to new points in the Near East as well as establish a route network to Africa possibly within the 1964-65 period. Bilateral agreements with the governments in these areas have not yet been negotiated.

Later this year, Malev will take delivery of its fourth Soviet IL-18 four-engine turboprop transport aircraft, displacing up to 99 passengers plus 4,095 U. S. tons of freight. By 1964 or 1965 the Hungarian carrier also hopes to introduce its first turboprop transport, probably with an initial wide of four, on most of its present IL-18 services to the West—Cologne, Madrid, Athens, Brussels, London, Frankfurt/Munich, Paris and Rome—all less than 1,000 mi from Budapest. Bert continued negotiations for the IL-18, according to Malev, is approximately 2,000 mi.

Therefore, in order to utilize its capabilities fully, the carrier is planning later on to use its IL-38 jet airplanes for the new route extensions to the Near East and Africa in addition to existing

services to Moscow. The aircraft also are being used to meet the growing demand among student and sport groups for charter flights during the peak travel periods to East and West European countries, according to Malev officials.

On June 1, the carrier introduced a new seven-week round-trip IL-18 service to Helsinki and later than the visit to Helsinki, probably on a two-week basis to Athens, the last major link, still missing in its West European route structure. Permission to land at Athens is now being negotiated.

Of the four different types of jet transports studied for its medium-range network, Malev says it favors the four-engine Boeing 747-100, capable of seating 400 passengers. The airline also is interested in the proposed Soviet IL-38 with four turbofans mounted in new under development, in the Ilyushin design group (AW May 19, p. 45; June 18, p. 15) and scheduled for service by late 1964 or early 1965. The existing two transports under consideration are British jet engine Vickers VC-10 and the British Aircraft Corp.'s Vis-



IL-38 ENGINE covers in pre-flight maintenance check in Malev's hangar at Fehérvár Airport. Complete plans to enlarge maintenance facilities.



EAST GERMAN IL-14 tests post arrival. Made L-14, B-14 and an B-14 at Paderborn. Car is analyzing both. Both and Waters built up to complete its fleet.

engine BAC 111 jet engine. Former Nader, Mader's technical director, told *Airways Week* that questions of equipment, not politics, determine his company's choice of equipment.

"Analog," the Soviet carrier, has a fleet of at least 500 IL-14s close to operation in addition to single large fleets of several other types," Nader said. "The Soviet Union is quite used to thinking in such vast numbers and it is somewhat, therefore, when we said East European states place an order with Russia or Western manufacturers. They only amount to about 25 aircraft at the most among us all at any one time."

Indication are, however, that Mader's choice of future equipment will, to some degree at least, be governed by what other scheduled carriers within the Soviet-controlled bloc order.

Steps already are being taken to pad the service and maintenance activities on all B-14s and by at least three East European airlines, with each sharing the load in accordance with its respective workshop facilities and available skilled labor. Aim is to achieve top efficiency while keeping the cost as low as possible by eliminating duplications of workshop equipment.

Mader, for example, probably will be

in charge of servicing of all B-14 aircraft equipment, CSA Czechoslovak Airlines of powerplant installation maintenance and LOT Polish Airlines of servicing and maintenance of the navigation equipment. According to Mader, this servicing procedure, which recently was introduced as a trial basis, is moving to satisfaction that new equipment recently purchased in sufficient quantities by the three undoubtedly will be carried out and checked for same use.

Mader's employees total 1,350 at present, including 36 pilots and 85 other flight personnel and air traffic control staff.

The carrier's fleet consists of three IL-14s, eight B-14s and twelve IL-22 (B-14s) in DC-10 built under license in Russia), all of which are based at Hungary's only international airport, Paderborn, located 75 km from the center of Budapest. Paderborn has a single 10,000-ft-long runway and is large enough to accommodate the present volume of passenger and aircraft traffic, although there is still ample room for expansion if the need arises.

At the moment, 12 flights scheduled courses were Budapest on a regular basis—East German Lufthansa, Aero flut, CSA Czechoslovak Airlines, Tassos Romanian Air Transport, Tatar Bulgarian Air Transport, LOT Polish Air

lines, Inep Airways, BMA British European Airways, SNA Scandinavian Airlines System and MEA Austrian Airlines.

In addition, Mader has agreements with 40 different foreign scheduled airlines and charter companies covering year-round charter flights to Budapest. Including the new service to Helsinki inaugurated on June 3, the company's medium-range network connects Budapest with 19 capitals in East and West Europe. Of these, 13 are operated on all routes to continue in West Europe except those to Zurich, Stockholm and Vienna, which are served by B-14s. B-14s also are equipped on all of the carrier's flights to East Europe, including Warsaw, Prague, Bucharest, Sofia and Tel Aviv.

Mader's 1963 B-14 and B-14 summer flight schedule comprises a total of 28 international round-trip flights a week. These include:

- B-14 from Budapest to Moscow three times a week. Budapest-Rome-Budapest twice via Frankfurt. Budapest-London via Frankfurt. Budapest-Amsterdam, twice a week to each terminal point. Budapest-Helsinki once a week, stopping at Copenhagen en route, at Stockholm on the return flight. This route, the carrier plans to extend its present B-14 Budapest-Stockholm service to Helsinki to replace the IL-14s over this new route commencing during the last busy winter season.
- B-14 from Budapest to East Berlin via Prague twice a week, East Berlin via Moscow once a week, once a week. Thence via Belgrade once a week, Budapest to Zurich, Budapest to Stockholm, Warsaw, Bucharest and Sofia each twice weekly.

The scheduled L-14s are used exclusively on the carrier's national network.

Domestic Airports

Mader maintains some domestic airports located near industrial centers throughout the country which are served on a regular twice-a-day basis—early morning and afternoon—throughout the week. Scheduled services include, particularly seasonal fruit and vegetables, much of which is distributed by air throughout Hungary, account for a good share of the company's growing air mail L-22 charter traffic. In addition, this fleet is used regularly for domestic tourist and student charter flights as well as for occasional special air-carrying assignments.

Many state-owned East European carriers such as Aeroflot, Aeroflot and CSA Czechoslovak Airlines, operate air ambulance and agricultural missions also, but Mader, the LOT Polish Airlines, does not include these services in its operations. The Hungarian Ministry of Agriculture, utilizing its own fleet

Malev Growth Pattern			
(1959-61)			
	1959	1960	1961
Total network mileage	7,560	8,712	9,594
Total miles flown per year	2,517,574	2,957,031	3,614,794
Total passengers carried	131,514	149,962	186,651
Total U.S. zone freight carried	1,800	3,778	2,081
Total passenger miles flown	2,922,145	3,468,566	4,270,566
U.S. zone freight miles flown	498,365	1,018,985	1,468,679
Overall tonnage flown	1,663,360	2,022,520	2,667,725
(passenger plus freight)			

of 16 P-14s (PZL-101 aircraft, it is responsible for all work connected with crop during and post control, while the Hungarian Ministry of Health has seven. Czech-built Aero-45 and one Czech Mavira L-200 for air ambulance duties.

Present annual utilization rate of Mader's B-14s averages about 1,600 hr., but the carrier hopes to improve this figure appreciably as soon as the aircraft can be employed on their present new long range routes to the Near East and Africa.

B-14s average between 1,190 and 1,570 hr. yearly, the L-22s between 880 and 980 hr.

Expanded Service

With the hope of additional new aircraft coming into service within the next few years, the company plans to extend its already expanding workshop and larger space at Paderborn Airport.

While space overhauls of the B-14s are frequent and complete are carried out in Moscow, Mader's technical staff now handles all other servicing and maintenance according to this schedule:

- B-14s airplanes, carried on a progressive maintenance check basis after every 100 flight hours requiring an average 195 man hours. Major overhaul in Moscow is made after 2,000 hr.
- B-14s airplanes, serviced after every 100 flight hours, requiring up to 240 man hours. Major overhaul is made after 2,000 flight hours, requiring 11,500 man hours.
- L-22 airplanes, first 100 hr. check in progressive maintenance program requires 90 man hours, the second 100 flight hour check in the schedule takes 260 man hours. Major overhaul is made after 1,600 flight hours, requiring approximately 8,500 man hours.

• A-10 helicopter components for the B-14s are checked after every 100 flight hours, requiring 65 man hours. Major overhaul in Moscow is carried out at present after every 610 flight hours.

• A-10-62 powerplants for the B-14s receive their first check after 100 flight hours, requiring 50 man hours. Major overhaul after 600 flight hours requires 600 man hours.

• L-22 A-10-62 powerplants are

checked after every 300 flight hours, requiring 120 man hours. Major overhaul after 600 hr. requires 273 man hours.

The first two B-14s went into service with the carrier in May, 1961, the third in April of this year. First three B-14s were delivered in 1957 and were followed by the remaining five of the type in 1958. The L-22s were placed in service with Mader between 1952 and 1954.

The carrier's present fleet is being trained center at Paderborn Airport, under military district Nader, a former Hungarian Air Force pilot and later a Mader test pilot. Shadowed as down from the air force and spent flying solo, with Mader's base equipment for inspection, being that the applicants must have completed a minimum of 100 flight hours prior to joining the service.

In accordance with the International Civil Aviation Organization regulations, they then receive one year of simulator and theoretical instruction, which is followed by another 100 flight hours, split on the L-22 and later on the B-14.

Mader's last jet B-14 crew—first pilot, co-pilot, navigator, radio operator and flight mechanics—received their initial instruction in Moscow. These crew are now responsible for the training of new B-14 pilot personnel. Mader pilots wishing to advance to the B-14 can qualify for training only after logging at least 621,000 flight hours on IL-14 aircraft.

Refresher Course

All Mader flight personnel are required to take a refresher ground course of at least four weeks and up to a maximum of an entire year, usually during the off-peak period of November and December, prior to an efficiency examination.

Training of the carrier's ground personnel is carried out at the State Technical College in Budapest and requires up to four years. Graduates then receive an additional year's training with each of the three airlines in areas such as Mader, but traffic control personnel at Paderborn are given one year's basic training

These trainees wishing to serve in other operations receive an additional one month's instruction. They qualify as air traffic controllers only after having completed an apprenticeship of five years' practical service.

Shortage of skilled personnel, particularly engineers, has contributed to the slow pace of the carrier's development during recent years. Mader pilots, that, unable to visit other Central European countries, Hungary took much of its manpower during two world wars and that many more men, among them large numbers of engineers, were "absorbed" by other states during the period of the second world war. These shortages, or at least the majority of them, are no longer as serious, and the gap to be bridged is a long and costly one for the carrier.

The want is new air, Nader said, and a new crop of technicians and engineers will soon be available.

Expansion for the training of flight personnel in one pilot, second pilot, co-pilot, navigator and radio operator is at least 52.5 million annually," he added. "Although we can afford such vast sums on training alone during our initial growth period, I believe you still have to prove that these funds, measured in terms of efficiency and safety, have been well invested."

Mader's pilot—several of whom have logged a total of more than 1.4 million flight hours, who are currently passed the 1.8 million flight-hourly maintenance examinations once every six months as traffic control personnel are checked once a year.

Malev Background

Declassified reports and a handful of scattered aircraft contributed the company's substance after World War 2. Financed jointly by Hungary and Soviet Union, a new company, a new company under the name of Magyar (Magyar Nemzeti Repulési Vállalat) (Magyar Nemzeti Repulési Vállalat) was founded on May 28, 1945. With an initial batch of 14 B-14s supplied by the Soviet Union, the carrier resumed its commercial operations in mid-October, 1946, with the establishment of domestic passenger and freight services, while continuing to rebuild and modernize its airports.

Second and third stages in its post-war reconstruction and development program included introduction of its routes to Hungary's neighbors in East Europe and then the extension of these routes to the construction of additional units to connect with a number of West European centers.

Since 1954, when the carrier's name was changed into the present Malev Hungarian Airlines, the company has been wholly owned and financed by the Hungarian government.

SHORTLINES

► Aeroflot has increased two-hour helicopter sightseeing flights over Moscow on Sundays. The "fantastic form of transport" has quickly become so popular that tickets must be booked in advance, the Soviet carrier said. Helicopters leave from a station on Leningrad Highway, circle over new ten-story hotels in the northern part of Moscow, land at Sheremetyevo Airport and then return.

► Alleghevy Airlines earned 1.12 million lb of freight, \$25,693 lb of cargo and 407,191 lb of mail in May. The totals, representing increases of 20%, 47%, and 44%, respectively over the same month last year, set company records, the airline said.

► Continental Air Lines' four new Boeing 733B jet transports are scheduled to be put in service July 16. Continental said it is spending more than \$1 million testing crews for the new aircraft.

► Federal Aviation Agency has recommended a special regulation allowing aircraft operators to experiment with cockpit lighting schemes. Operators of the approximately 100 aircraft equipped with non-standard cockpit lighting will have one year to phase out their systems. FAA and results of the experiments were "inconclusive."

► Los Angeles Board of Airport Commissioners has approved a \$15 million 1982-83 budget—an increase of \$1.2 million over the last fiscal year. Increase in the budget was due largely to cost of operating Los Angeles International Airport's new jet terminal during its first full year of service.

► N. E. Babbie, Federal Aviation Agency administrator, will hold a "longer flight" seminar with general aviation pilots from Ohio and surrounding states at Kenner Airport, Cincinnati, July 16. He will discuss and answer questions on FAA regulations and policies affecting general aviation.

► Trans International Airlines, a U. S. supplemental carrier, plans to put its new DC-8 jet transport into transoceanic service under a Military Air Transport Service contract this month.

► Trans World Airlines and its rival, its highest single-day volume of group discount fare traffic on June 29, with 61% of the company passengers on all scheduled transcon flights were traveling at the group rate.

AIRLINE OBSERVER

► Eastern Air Lines chose to let its flight engineers strike rather than appeal for a federal injunction because of heavy revenue losses from canceled reservations and low advance bookings. Eastern blamed the loss on public uncertainty due to the strike score. Eastern felt an injunction or restraining order would not dispel public doubts about operations, close to shut-down and hope for a permanent settlement.

► United Air Lines is maintaining a flexible attitude on the future of its Sud Caravelle two-engine jet transports. Expectations of a crash-landed plane accident for the airplane may cause it will phase out the Caravelles when United's Boeing 727 transports are delivered, or it may keep the Caravelles and phase out the Boeing 720s instead. Telling now is that United would buy only two jet aircraft for its entire fleet—the Douglas DC-8 and the 727—if it could do so ordering all over again.

► Soviet Mi-6 helicopter has been placed into mass production, according to the newspaper Mirovaya Pressa. Several Mi-6s have been delivered to the Moscow city helicopter station, the paper said, and quoted station chief I. Mikhov as saying "we'll soon have them in regular service."

► U. S. airlines spent \$2.6 billion for foreign travel in 1962, about the same as in 1960, according to the Commerce Department. Of this amount, \$460 million was paid for transportation to U. S. airlines and shipping companies. Foreigners visiting here in 1961 spent \$1 billion, of which \$122 million was paid to airlines to U. S. carriers. U. S. travel expenditures in Canada rose 12% in 1961 over the previous year, but dropped 10% in Europe and the Mediterranean area.

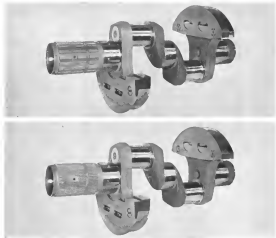
► Western Air Lines will operate Boeing 733B transports on the Los Angeles-Houston route in the strong likelihood it will be certified by the Civil Aeronautics Board as the third U. S. Boeing-Carlson carrier. Airline officials, anticipating certification measures this fall, have been discussing space requirements at Hancock International Airport terminal and servicing after arrival in downtown Honolulu and Waikiki.

► United Air Lines has completed wiring for transponders on all 47 Vickers Viscount turboprop transports acquired as its engine with Capital Airlines and will begin installing the work this month. Wiring for DME on 19 Viscounts has been completed and seat installations will start late this month.

► British European Airways has introduced a paint system for its 470 Comet pilots to affect the increased workload imposed by turboprop flights. Under a recommendation made by the Air Ministry Flying Personnel Research Committee in answer to pilot complaints, pilot flight times are being based on the relative amount of work required on various routes, with the most points allocated for those with high traffic density and frequent stops. Pilots are also permitted to bid for periodic assignment to less demanding routes.

► Russia's four-engine Ilyushin IL-16 transports are now flying 57 of Aeroflot's routes. Latest IL-16s arrive at between Leningrad and Ekaterin, capital of Anatolia. Aeroflot says that turboprop and turboprop transports are now being used for about 780 of the more than 1,000 flights listed in its current trunk route timetable.

► British Overseas Airways Corp., in solving the problem in Britain over its VC-10 plus (AW June 15, p. 57), is not changing the door to purchase of long-range Boeing 707s to provide service London-Los Angeles service. It proposes by Vickers for modifications are approved this fall, delivery of its own as nine modified airplanes is contemplated by 1973. So far, British parent, BOAC managing director, is using the term "new equipment" in discussing the problem. BOAC will buy in the interim with four extra new problems in the early operating 707-300s. Conviction of some of BOAC's 707s in service also is a possibility instead of a new order.



Which crankshaft is 8 ways better?

In 1946, when the R-2800 crankshaft (top) entered commercial service, it had a comparatively short life by today's standards.

Since then, Pratt & Whitney Aircraft has incorporated eight major design improvements that have increased operating life to as much as 17,000 hours.

This crankshaft typifies the changes for the better constantly being made in Pratt & Whitney Aircraft original equipment parts. Using knowledge gained in countless hours of laboratory testing and field evaluation, parts are continually refined to improve performance and increase reliability.

Only components made to the latest Pratt & Whitney Aircraft specifications incorporate all design changes. Without access to these improvements no substitute can meet the standards of dependability built into every Pratt & Whitney Aircraft engine. Original equipment parts are quickly available direct from Pratt & Whitney Aircraft or from its authorized distributors in the United States and Canada.



By 1946, when the R-2800 crankshaft (top) entered commercial service, it had a comparatively short life by today's standards.

Pratt & Whitney Aircraft

East Hartford, Connecticut

Canadian Pratt & Whitney Aircraft Co., Ltd.

Longwood, P. Q., Canada



AUGUST 21, 1954 NORTH ATLANTIC OCEAN

Yesterday—Suddenly, from behind a curtain of fog, an enormous, glittering wall of ice loomed before the two planes. Twisting, nearly over on their backs, they cleared for the sky. The first flight crossed the world record en route by radio.

It was the last and most terrifying incident in the dramatic epic of four Army Air Service planes. In open-cockpit Douglas C-54s, they conquered subzero blizzards, treacherous seas, desert sandwiches and ocean fog.

The flight was also a triumph for those who planned and manned the setting of speed records against the fiercest weather. They flew with Standard Oil Red Crown Aviation Gasoline.

Today—In his wingless, pear-shaped capsule, an astronaut can circle the world in about 88 minutes. Pay, status and comforts won't cross his path. A rocketeer could.

Fast and far out all this world though he flies, the astronaut still shares one important concern with the globe-girdler of yesterday—and with anyone who flies today—the need for careful service on his craft.

Chevron Airport Dealers don't fuel rockets, but they do give friendly, thorough attention to pilots and planes. Service is their business. They're extra careful with gas crows, dispatches and windshields. That's why, in the West, pilots look for the sign of the Chevron.



Chevron Airport Dealers take time out of your stop—no less 30¢ of the daily flying agenda.

STANDARD OIL COMPANY OF CALIFORNIA

Airline Income and Expenses—March, 1962

	Passenger Revenue	U.S. Mail	Freight	Charters	Total Operating Revenues	Total Operating Expenses	Net Income Before Taxes
DOMESTIC LINES							
American	\$1,774,818	467,731	884,455	2,370,348	5,497,352	35,918,647	32,428,691
Boeing	6,509,271	179,778	32,348	270,262	7,191,659	3,125,775	4,065,884
Continental	3,423,850	121,680	37,080	100,000	3,682,610	6,816,800	4,166,810
Delta	15,154,696	787,682	140,000	919,800	16,982,178	14,799,800	2,182,378
Eastern	29,075,943	254,449	1,618,135	1,335,777	32,284,204	26,698,377	5,585,827
Norfolk	3,386,421	153,212	13,632	202,945	3,756,210	3,295,459	460,751
Northwest	4,713,306	98,261	36,747	58,261	4,906,575	3,516,306	1,390,269
Northwest	6,711,150	325,490	583,500	1,000,000	8,620,140	7,611,376	1,008,764
Trans World	16,862,241	289,970	1,416,244	1,081,140	19,649,595	15,700,140	3,949,455
United	20,075,238	1,444,274	2,233,517	1,081,140	25,834,169	21,855,952	3,978,217
Western	8,837,318	117,621	—	213,891	9,168,830	6,001,073	3,167,757
INTERNATIONAL							
American	756,124	4,370	208	18,219	778,721	634,533	144,188
Boeing	762,639	21,487	—	82,544	866,670	1,818,115	-(951,445)
Continental	479,338	3,071	—	36,747	519,156	453,181	65,975
Delta	762,639	1,000	—	—	763,639	1,344,000	-(580,361)
Eastern	2,994,454	48,719	—	173,848	3,217,021	3,807,140	-(590,119)
Norfolk	152,281	—	761	6,875	160,917	177,342	-(16,425)
Northwest	2,175,237	93,473	—	376,384	2,645,100	2,444,530	200,570
Northwest	27,226,000	3,187,000	—	4,372,800	34,785,800	30,101,000	4,684,800
Alaska	207,000	22,000	—	46,000	275,000	745,000	-(470,000)
Alaska	10,499,000	1,611,000	—	3,300,000	15,410,000	15,711,000	-(301,000)
Latin America	8,367,000	288,000	—	3,200,000	11,855,000	10,571,000	1,284,000
Pacific	7,938,000	1,481,000	—	1,200,000	10,619,000	12,484,000	-(1,865,000)
Pacific	1,411,000	300,000	—	300,000	2,011,000	2,011,000	—
South Pacific	34,254	1,254	—	494	36,002	37,370	-(1,368)
Trans World	6,682,000	1,066,000	—	732,800	8,480,800	6,769,000	1,711,800
United	2,182,111	113,019	—	87,244	2,382,374	2,416,711	-(34,337)
Western	251,446	5,849	—	12,514	269,809	492,164	-(222,355)
LOCAL SERVICE							
Allegany	1,126,116	24,720	10,178	46,420	1,207,434	1,788,200	-(580,766)
Boeing	611,742	2,344	—	9,191	623,277	725,779	-(102,502)
Continental	438,018	16,311	—	17,191	471,520	769,714	-(298,194)
Frontier	802,548	13,244	3,490	35,562	854,844	1,268,714	-(413,870)
Midwest	505,817	10,516	14,764	15,000	536,097	883,071	-(346,974)
Norfolk	1,705,140	17,842	17,125	10,842	1,750,949	2,582,847	-(831,898)
North Central	1,515,210	26,515	36,400	48,292	1,606,417	2,118,451	-(512,034)
Omaha	754,400	13,112	10,178	10,178	787,868	1,236,291	-(448,423)
Pacific	875,900	13,794	726	10,071	890,491	1,000,000	-(109,509)
Piedmont	746,524	13,440	4,740	17,000	777,704	1,165,827	-(388,123)
Southwest	543,400	10,516	10,178	10,178	574,272	769,714	-(195,442)
Trans World	326,813	3,246	4,341	20,275	354,675	1,008,000	-(653,325)
West Coast	346,120	10,832	3,426	12,817	373,285	1,043,701	-(670,416)
HAWAIIAN LINES							
Alaska	363,816	3,274	—	4,600	371,690	418,832	-(47,142)
Hawaii	446,318	3,656	1,661	55,845	497,480	646,234	-(148,754)
CARGO LINES							
Alaska	—	—	—	850,874	850,874	1,486,121	-(635,247)
Boeing	—	—	—	1,626,852	1,626,852	2,217,729	-(590,877)
Continental	—	—	—	85,837	85,837	1,217,147	-(1,131,310)
Delta	—	—	—	1,626,852	1,626,852	1,964,992	-(338,140)
HELICOPTER LINES							
Chesapeake	50,373	83,788	3,864	—	138,025	187,448	-(49,423)
Los Angeles Airways	22,411	15,845	—	—	38,256	142,452	-(104,196)
New York Airways	97,221	211	2,794	2,917	103,143	219,328	-(116,185)
ALASKA LINES							
Alaska Airlines	242,121	45,846	867	37,751	326,585	616,845	-(290,260)
Alaska Airlines	31,744	8,796	—	1,343	41,883	152,848	-(110,965)
Continental	17,227	10,788	—	14,143	42,158	119,128	-(76,970)
Ketchikan	10,166	616	—	1,660	12,442	22,871	-(10,429)
Northwest	44,534	48,515	—	48,515	141,564	244,644	-(103,080)
Pacific Northwest	373,808	80,883	3,999	121,134	580,824	907,355	-(326,531)
Pacific Northwest	68,674	18,277	—	38,687	125,638	196,474	-(70,836)
Pacific Northwest	6,312	15,192	—	17,504	39,008	79,556	-(40,548)
West Alaska	68,528	75,610	—	35,742	179,880	494,834	-(314,954)

*Property includes airports, freight and express baggage revenues.
 †Net Profit to Loss
 ‡Passenger Charter Revenue
 ‣Money gain includes bookkeeping adjustments and cost from February
 ․Losses for American and Alaska Airlines and Alaska Airlines are not included, Alaska Air Transport is reported in the monthly financial statements of the Civil Aeronautics Board.
 ††Includes contract revenue.
 ‡‡Includes revenue from charter.
 †††Includes "other" income by Flying Tiger

AO-1 MOHAWK FEATURES EASY MAINTENANCE

Grumman's AO-1 Mohawk, new observation plane, was designed for short take-off and landing, operation from rough fields, high maneuverability, and maximum visibility for the two-man crew. Since it will live in the field with today's military, ease of maintenance is essential... and here's how the Mohawk meets maintenance requirements!

- 1 INTERCHANGEABILITY**—Left- and right-hand components on the Mohawk are interchangeable, including tail surfaces, engine power plant passages, landing gear.
- 2 SERVICEABILITY**—Engines on the Mohawk, including accessories, can be changed with standard tools—a minimum of special tools is required. That's what you call easy serviceability!
- 3 ACCESSIBILITY**—75% of the Mohawk opens up for maintenance in a matter of seconds, and this is done entirely by hand. And this is accomplished at ground level, thus eliminating aircraft stands, ladders, and other paraphernalia often unavailable in the field. That's what you call easy maintenance!



GRUMMAN MOHAWK



Grumman Aircraft Engineering Corporation, Bethpage, L.I., N.Y.

AIR CARGO ENTERS THE JET AGE....



The newly announced Boeing 707-320C cargo jet represents an important air freight breakthrough. For the first time, air cargo will be able to move as volume at jet-airline speeds. Shippers will enjoy the advantages of "best-in-class" delivery in volume, across a continent, or across oceans.

The latest member of the Boeing jet family, the 320C is a development of the 707-320B turbofan international. It retains all major systems and components, thus allowing the economy of standardized spare parts, ground handling equipment and training.

Already purchased by two carriers—Pan American and World Airways—the 320C has a cargo payload of more than 45 tons over a range of 3500 miles. The

upper deck is readily convertible to all-passenger, all-cargo or combination configurations. Cruise speed will fall payload to 575 mph.

The brilliant new 707-320C was designed to provide the lowest cost-per-mile cargo service and the highest reliability. It will open a new chapter in world-wide air cargo growth while it goes into service next year with Pan American World Airways and World Airways.



BOEING CARGO JET

Airline Income and Expenses—1st Quarter, 1962

	Passenger Revenue	U.S. Mail	Freight*	Charter	Federal Subsidy	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNKS								
American	10,470,630	2,469,369	8,621,478	369,332	---	21,930,809	19,585,403	1,478,740
Boeing	19,911,111	116,728	1,711,375	75,963	---	20,715,177	19,561,363	345,636
Continental	16,520,027	326,343	892,488	49,353	---	17,788,193	16,771,765	345,207
Delta	41,379,071	736,456	2,342,376	28,607	---	44,426,420	39,651,911	4,477,210
Eastern	79,787,458	1,644,458	3,759,384	26,461	---	85,177,761	79,251,648	5,926,113
Northwest	22,496,111	412,311	1,751,528	114,814	---	24,674,864	20,851,448	3,823,416
Southwest	13,265,656	179,237	577,435	16,844	---	14,039,172	13,761,889	277,283
Northwest	15,817,946	863,200	1,144,231	12,844	---	17,838,181	16,735,449	1,102,732
Trans World	61,218,378	3,618,512	1,118,328	436,886	---	66,391,104	59,288,572	6,549,380
United	29,788,911	2,676,544	8,277,071	210,414	---	31,853,940	29,524,514	2,329,426
Western	18,567,873	344,388	672,742	96,932	---	19,681,935	16,747,911	2,934,024
INTERNATIONAL								
American	5,336,936	8,330	139,480	13,884	---	5,386,630	1,627,726	418,462
Boeing	2,957,389	106,448	227,815	---	---	3,291,732	5,005,688	478,451
Continental	1,225,319	76,161	5,335	---	---	1,306,815	3,259,102	291,558
Delta	216,618	750	23,719	---	---	217,387	495,259	144,413
Eastern	8,626,465	167,638	475,264	---	---	9,269,367	8,545,738	723,629
Northwest	675,567	---	29,727	3,779	---	705,313	567,491	137,822
Southwest	5,498,512	3,259,440	596,434	372,616	---	9,727,002	9,667,365	59,637
Pan American	72,454,506	2,302,433	12,774,276	5,125,415	---	92,556,630	105,496,484	6,569,145
Alaska	625,471	43,129	123,340	---	---	791,940	1,025,430	231,489
Adair	26,871,490	1,468,251	1,384,384	1,228,800	---	29,952,925	40,632,812	7,122,269
Latin America	26,497,343	139,341	1,159,020	265,473	---	27,901,177	30,184,766	1,037,529
Pacific	26,644,634	3,965,457	2,444,291	3,646,729	---	32,945,111	29,514,886	2,490,181
Panama	4,321,878	185,344	926,721	41,806	---	5,435,749	5,218,905	216,844
South Pacific	71,471	1,126	---	---	---	72,597	222,550	150,047
Trans World	3,343,296	---	56,862	6,028	---	3,406,186	3,341,770	276,169
United	11,620,625	2,867,417	1,677,494	171,347	---	16,236,983	17,770,424	228,486
Western	5,459,859	244,349	244,162	26,436	---	5,974,806	5,109,216	1,865,590
Western	1,715,623	6,423	26,140	---	---	1,748,186	1,273,483	474,703
LOCAL SERVICE								
Allegheny	3,196,955	47,299	249,482	3,776	---	3,497,512	5,143,928	178,247
Panama	1,728,092	12,622	37,488	395	---	1,778,597	2,569,102	786,505
Central	1,183,776	44,863	72,424	19,433	---	1,216,536	2,469,219	118,337
Frontier	1,208,940	37,847	105,645	39,102	---	1,391,534	3,376,479	2,482
Lois Central	34,429,183	1,745	1,745	---	---	34,432,673	34,432,673	---
Midwest	2,286,891	81,864	161,634	8,283	---	2,538,672	5,345,769	3,112,111
North Central	3,616,002	883,399	223,273	46,169	---	4,769,843	6,136,866	4,108,944
Quick	2,185,834	92,923	124,149	1,166,468	---	2,509,574	2,428,414	81,160
Pacific	1,474,314	37,245	77,639	14,816	---	1,594,018	2,468,877	71,430
Panama	2,644,967	26,442	46,761	40,231	---	2,768,401	2,618,506	274,694
Swansea	1,234,274	12,243	29,293	12,713	---	1,288,520	2,374,264	75,141
Trans-World	1,461,480	49,670	14,824	31,431	---	1,557,415	2,165,148	32,776
West Coast	1,553,432	29,643	32,835	7,931	---	1,623,841	2,454,036	57,564
HAWAIIAN LINES								
Alaska	1,647,694	4,008	18,820	---	---	1,669,522	1,196,598	472,924
Hawaii	1,101,474	90,445	245,993	4,771	---	1,443,683	1,876,561	278,238
CARGO LINES								
American Mail	---	---	326,755	182,085	---	508,840	380,771	48,306
Ping Pong	---	148,635	3,171,148	8,892,617	---	12,212,400	12,212,400	---
Stella	---	20,495	---	---	---	20,495	4,414,426	4,393,931
Standard World	---	145,322	2,414,547	125,432	---	2,665,201	3,166,720	558,520
Black	---	---	---	4,223,416	---	4,223,416	5,977,711	1,754,295
HELICOPTER LINES								
Chicago Helicopters	104,927	12,265	5,934	---	---	123,126	291,749	168,621
Los Angeles Airways	49,188	38,846	61,820	475	---	149,529	374,521	224,521
New York Airways	291,752	2,175	14,443	37,737	---	326,107	664,521	338,417
ALASKA LINES								
Alaska Airlines	740,064	145,256	115,200	476,473	---	1,071,000	2,045,941	403,367
Alaska Central	178,934	25,120	12,470	4,858	---	217,382	477,073	264,633
Central	49,476	32,779	36,227	39,819	---	128,301	231,134	3,762
Delta	1,092	12,389	---	---	---	13,481	973	6,408
Eastern	32,726	2,714	5,154	5,332	---	45,926	57,446	31,480
Northwest	176,209	212,370	91,559	30,290	---	570,428	756,317	134,111
Northwest	7,224,344	381,912	2,222,340	11,832	---	9,830,428	12,212,400	2,617,028
Panama	276,326	143,118	91,341	36,814	---	547,599	512,842	2,757
Western Alaska	1,254,744	---	1,146	---	---	1,255,890	2,414,446	2,141,544
West Alaska	167,236	212,329	10,849	128,418	---	518,832	1,358,424	36,279
Alaska Air Transport	50,871	4,388	1,197	37,153	---	93,609	106,559	17,444

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board. *U.S. Combined Domestic and Overseas.

*Freight. Figures include express, freight and excess baggage revenue.

Fiscal 1962 Laser Funding Completed

By Barry Miller

Los Angeles—Several million dollars in optical sensor research and development contracts were negotiated in recent weeks at Army, Navy and Air Force agencies hurried to finally bring the fiscal round of 1962 awards before the July 1 fiscal deadline.

The potential use of the optical sensor (laser) in industrial weapons (AW May 26, p. 81) continues to be one of the leading motives for military and Department of Defense support of R&D in this field. Indications are that a consensus has not been reached yet in the military about feasibility of laser weapons, and may not be for some time, but at least which have any glimmer of promise are coming under government funding.

Meanwhile, several companies—Bell Telephone Laboratories, Hughes Aircraft, American Optical and Electro-Optical Systems—have made known recent developments relating to them.

Other Uses

Many laser contracts awarded by July 1 center on fields of military interest other than military weapons—tracking, surveillance, navigation and remote communications—and have more role work content in more potential applications. Yet at least half of the more than \$10 million in Fiscal 1962 and 1963 laser funding, plus carry-over funds already allocated, can be traced directly to research in exploring laser weapon concepts.

Advanced Research Projects Agency is expected to continue its funding of

the Office of Naval Research effort in induction weapons. ONR officials in particular view considerable disappointment with results of 14 parallel 45-laser laser weapon system feasibility studies conducted recently (AW Apr. 30, p. 79), but are expected to follow these with several further studies.

The Navy had placed surface light requirements on these studies, insisting consideration of laser materials in the solid and integrated relay optical and semiconductor in glass in the latter period that would be required to develop tactical weapons, others were promising materials may be advanced sufficiently to be more capable of supplying the high energy outputs needed for weapons.

To back up its weapons program, ONR recently awarded a total of about \$250,000 in contracts to improve new designs in glass to General Glass Co. and Eastman Kodak. Similar materials improvement contracts for relay are expected.

Second Program

Besides the ONR program, ARPA is initiating a second weapons program through the Air Force Special Weapons Center at Kirtland AFB, N. M. Proposals for two contracts, each of the introduction of laser radiation with materials and developing instrumentation for assessing high-intensity role sensors, were submitted before the month (AW June 11, p. 90). A third contract, for development of high-intensity optical sensor, may follow soon in this program, estimated in range upwards of \$500,000 in value.

In addition, ARPA recently renewed for the fourth consecutive year its funding of a large, many-faceted, laser program at Tufts Research Group, one of the earliest projects in this field. The three 1962 contracts in this program, to be valued at \$5 million, thereby bringing the total cumulative funding for the program to about \$1 million. While details concerned with materials, control, power and detection, the program may now be oriented more toward combined weapon instrumentation.

Both Air Force and Navy are sharing interest in a communications system, such as Space Systems Division's project called Rhet. Eve (AW May 21, p. 23, June 25, p. 72) which would use laser beams to beam out data from space vehicle sensors, such as high altitude infrared sensors. Various systems, based to a spacecraft, may be for



HIGH POWER LASER BEAM, with energy of 71 joules, hits metal off-axis steel plate (A) when focused at spot (B) in distance, producing burning plasma. Glass shows dense, in front spot of American Optical Company research center. Goggles are in last achieved line output of 121 joules from an 18-in. long solid rod of neodymium-doped glass measuring 1 in. diameter. Beam spread was 30 deg and pulse duration was less than two microseconds, company says.

more practical or favorable steps of laser development than a weapon system capable of destroying hostile missiles or spacecraft.

Among other contracts directly related to optical sensors, which were awarded recently, are:

- **Satellite Tracking**—Technical Research Group will develop a laser ranging system to be used with a 40-in. telescope to track American satellites from Chidwell's N. M. in the White Sands Missile Range under a \$500,000 contract from USAF's Aerospace Systems Division (ASD). American Astronautics, which is making the telescope, contract will be a subprime to its Technical Research. Mrs. L. Bernstein, El Paso Tex., contractor, will prepare the south eye Nov. Mission test.

- **Optical Computers**—Radio Corp. of America will start development in optical working computers, using optical master techniques and glass fibers. Offer optical in waveguides under a \$97,000 contract from Rome Air Development Center.

- **Acousto-Optic**—Wang Laboratories will develop a high-speed, optical device for processing data in a computer. Contract is valued at \$225,000.

- **Acousto-Optic**—Wang Laboratories will develop a high-speed, optical device for processing data in a computer. Contract is valued at \$225,000.

last of about \$200,000. Quantitative, for, with a separate study program of about \$270,000 in part of the same project, which coordinates the Air Force's own optical sensor induction weapons effort.

- **Strategic Defense**—Electronic-Industrial Business Machines Corp. will conduct investigations of electron as part of its development, a technique analogous to electron cathodes in a laser discharge, as a source of ionizing laser action. The \$75,000 contract from the Army Signal Corps adds \$500 to Watson Johnson and Electro-Optical Systems on the list of companies studying this technique under government contract (AW May 12, p. 199).

- **Laser Welding Techniques**—Team of Technical Research Group and General Research Engineering Corp. was selected by ASD to develop techniques for using high-intensity laser beams for welding (AW Apr. 23, p. 19). Contract is estimated at \$225,000.

- **Radiation Sensor**—Polaris Corp. will start research in developing a high-speed, optical device for processing data in a computer. Contract is valued at \$225,000.

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- **Coupling Laser-Technical**—Optical Systems, Inc., is doing a theoretical investigation of techniques for coupling two laser together using a \$50,000 contract from USAF's Electronic Systems Division.

- **Deflect Modulation-Raytheon** is studying advanced modulator techniques. Study may have application in IR communications under a Space Systems Division contract.

- **Optical Mass Phenomena**—Stanford University will study optical and radio and mass and electron plasma phenomena under a \$60,000 contract from USAF Office of Scientific Research.

- **Laser Radiation—Lighting and Transmittance**—Research Institute will examine the application of laser radiation beams to high-voltage phenomena. Work is being performed under a \$50,000 Air Force Systems Division contract.

- **Optics—Massachusetts Institute of Technology** has secured \$100,000 from the Air Force Office of Scientific Research to study coherent light and radio optics.

Other major programs, the disposition of which now being shifted in most cases during the past week, include: Theoretical and Applied Advanced Laser Research (Army, U. S. Navy), Phase-Air Laser Weapon Study (ASD), High-Intensity Laser Techniques (Signal Corps), and High-Intensity Laser (ASD).

Range Finder

Signal Corps may soon announce award of a large contract for development contract for which it has assumed responsibility after studies conducted last year by Hughes Aircraft and Technical Research Group for the Army's Tactical Airborne Laser (AW May 12, p. 199) had demonstrated a laser device applicable to tank ranging earlier this year at Ft. Monmouth. It was capable of locating a strike about 1,000 yd away with an error of about 1 ft. Area is known to have a strong interest in helicopter-based laser range finders.

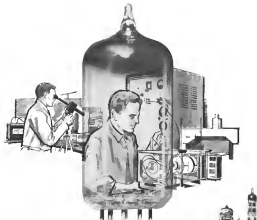
A few recent technical advances are being reported by companies active in this field.

- **High-Energy Outputs**—American Optical reports it has increased its output energy in watt-second, or joules, of 115 Joule duration from the 16-in. long, 4-in. dia. glass rod, doped with neodymium, was less than 2 millicoulombs. The device operated at room temperature. Energy density for the laser was 5 joules/cm².

- **High Power**—Quantum Inc. has achieved 50 megawatt peak power output from a Kerr cell modulated ruby laser. Pulse duration was 10 nanoseconds, which provides an energy of 1 joule.



HEAVY AIRCRAFT—on receiver reflect a laser which will focus light generated by other optical sensor in glass tube, center of glass tube with active ruby crystal located between magnetic pole lines in right. Optically pumped master generates radiation at 254 laser, technique allows possible higher frequency for submillimeter wave studies.



This quiet revolution in components vitaly affects your avionics equipment reliability

Without benefit of further electronic vacuum tube has quietly made astounding gains in reliability over the past decade. Data accumulated from 1952 to date in Sylvarnia Gold Brand Semiconductors Tubes reveal an impressive decline in potential failure rate—from an average of 5.3% / 1000 hours to approximately 0.275% / 1000 hours.

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more severe than encountered in actual field usage. Example: shocks of 500g, fatigue tests of 2.5g for 96 hours, bath temperatures of 165°C. Judge samples are *also* tested under high temperatures for 500 and 1000 hours in air. Sylvarnia GB Gold Brand Tubes are built to assure dependable operation of your electronic "eyes and ears."

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RAYTHEON gas laser uses helium-neon ion laser and contains more than 100,000 tubes and components.

► **New Push-This-Fits-Tenitor Effort**—An evaluation of this ten-year project leading to the development of active elements will be conducted in Los Angeles Solid State Physics Laboratory for Navy's Bureau of Ships under a \$77,000 contract. Company, which is investigating capabilities of this ten-year project, has a contract with the U.S. Government for the development of a ten-year project.

► **USAF Pushes Future Atomic Needs**—A number of Air Force planning studies intended to explore atomic requirements extending into the 1970s has been put forward by the Air Force in USAF's Electronic Systems Division (AW) June 18, p. 21. Proposals for planning study number 7990.13 calling for investigation of global communications systems requirements from 1975 to 1979 period are due at OSD by July 27. At least one contract is to be awarded. These contracts, two of them funded, are awarded initially for studies of research and development of needed systems in the 1970s to 1979 period. Planning study 7990.21, Master Missile (Missile) and Radar Wave Study Division of TAW received \$125,000 task to conduct period 7990.22 studies while Laramie Data Systems will perform an extended study of a modified version of its Marine Tactical Data System under the same planning study. Amongst Radar/Wave Study, in studies (AW June 25, p. 21) will be United Aircraft (unclassified) and, Airborne Instruments (under 6 months) and other Electronics (communications). Previously, Northrop, Radio Corp. of America and North American Signal Systems divisions Division were picked to complete studies of future research and development in the 1970s to 1979 period. Planning study 7990.21 (AW June 25, p. 21, p. 22).

► **Transmit Sales Up and Down**—U. S. semiconductor manufacturers sold 10 million transistors during first six months of the year, an increase of 44% over last year's sales (see page 19). But dollar volume of 555.8 million is down 64% from income on lower unit sales during previous year.

► **Soviet Translators Machine**—U. S. now has translations of about 100,000 technical articles from Soviet publications. Now translators, available through the Special Language Assistance Translators Center, Government Department of Office of Technical Services and other known sources, are

used in semiconducting publications carried Technical Translations. The publication is available at subscription rate of \$12 per year from the U. S. Government Printing Office, Wash. region 25 D C.

► **Western Electronics Cases**—Sales of electronics companies in 11 western states are expected to reach \$3.1 billion this year representing about 35% of estimated U. S. total of \$3.5 billion, according to survey by Western Electronic Manufacturers Association. Sales in current year are estimated at 9% above 1961. More than half the total is centered in the greater Los Angeles area.

► **"Black Boxes" on the Way Out?**—The expression "black box," a words and phrase term which arose from the black cockpit crash box used to capture last description of avionic equipment, may be the victim of transformation, according to the British Mission Group. Because black is a dark color and coming in as a word in a word, with transmission equipment. More than 500,000 such avionic equipment will be found in avionic equipment limited cases, company says.

► **ARPA Reels Up New IR Study**—Advanced Research Project Agency is putting more money into its lagging infrared target and background measurement—its own research—on a contract from instrumented study, by Naval Ordnance Test Station at China Lake, Calif. Program known as IRAC, or Infrared (AW June 2, p. 61, July 1, 1961, p. 7) is designed to obtain signal-to-noise ratio of infrared image targets over selected optical region in the infrared and ultraviolet. Other research project developments in infrared include: 1. Infrared background discrimination study will be conducted by Electronic Systems & Products Division of Martin Co., Baltimore, by the Office of Naval Research in an effort to develop improved infrared detection systems. A Martin-developed multi-element infrared detector array will be field tested as part of the study.

► **Houston contracts for Saturn Booster** will be fabricated by Martin to Marshall Space Flight Center specifications under a \$101,000 contract.

► **Rockwell periods for phase 2 of Project Trump**, an Air Force civilian management program (AW Apr. 2, p. 61), will be fabricated under a contract expected to be awarded soon by USAF's Space Systems Division.

Navy Program Spurs Microcircuitry Use

By Philip J. Kiss

Washington—Branch of Naval Weapons has launched a pilot program to introduce semiconductor and thin-film microcircuitry into a broad spectrum of its various equipment, both current production and new equipment under development.

The ambitious BuWeps program includes the following:

- Substitution of microcircuits on a piecemeal basis in current production hardware wherever it can be done without increasing equipment size.
- New, allow-once-only equipment to be developed from the start to use the new technique throughout.

• Evaluation facility, established at Naval Air Development Center, to test all new semiconductor and new package as parts to update designs on the availability of different types of circuit functions.

• Survey of BuWeps supplies to determine what semiconductor functions are needed, with this information made available to producers of microcircuits to guide their development efforts.

Navy expects to achieve size and weight reductions of 60-90% in all microcircuit variants of its tactical guidance systems to be developed by Littion Industries, a new Los Angeles navigation receiver to be designed by Sperry Gyroscope Co., and a new high frequency communications receiver being developed by Radio Corp. of America. Contracts to Littion and Sperry have just been awarded.

Reliability, Economy

While size and weight savings are important, the primary objective of the program is to achieve a 10-fold improvement in operational reliability and a corresponding reduction in maintenance costs, according to Col. Arthur C. Lowell, USMC, chief of BuWeps' Avionics Division.

Col. Lowell believes signal equipment production costs can be cut 25-40% when more widespread use of microcircuits allows a reduction in the per cent of initial testing and debugging. BuWeps hopes to standardize a relatively modest number of microcircuits and get industry designers to use them wherever possible.

BuWeps has launched a program to encourage its hardware producers to substitute microcircuits on a piecemeal basis in current production items wherever this can be done at no increase in contract cost.

One of the first equipments to switch to microcircuitry on a piecemeal basis will be a digital navigation

computer which Littion Industries is producing for the German Navy aircraft. Many of the program's most basic skills now used in conventional hardware, motion and expansion will be replaced with equivalent functions boards of the same dimensions using only semiconductor microcircuits made by Fairchild and Texas Instruments.

Approximately 5,000 of the microcircuit elements will go into each computer. This one program is expected to use nearly half a million of the semi-conductor microcircuits, according to Col. Lowell. Part of the microcircuit computer is expected to be flying next summer.

Small Weight Benefit

To maintain interchangeability, with earlier computers and their plug-in cards, there will be no attempt to reduce overall equipment size, and there will be only a 15 lb weight reduction.

But if the microcircuits live up to industrial standards as reliability, there should be substantial savings to the Navy in maintenance costs and improved operational reliability, Col. Lowell said.

A number of BuWeps contractors are studying the possible substitution of microcircuits, and several are making specific proposals. This includes General Electric, Lord Electronics, Nucleon Division of United Aircraft and Sanders Associates, Col. Lowell said.

Meanwhile, BuWeps has contracted with Avco Research Corp. to conduct detailed field studies to determine the reliability and maintenance costs at present equipment so that Navy will have an accurate benchmark for comparison of the new hardware using microcircuitry.

Test Center

The Naval Air Development Center (NADC), Johnsville, Pa., has been set up to function as an evaluation and substitution center on microcircuitry for BuWeps and its industry contractors.

NADC plans to evaluate all existing and newly developed microcircuits from industry and publish a monthly accessibility to inform industry's experience of the test results. In this manner, BuWeps hopes to keep equipment designers posted on currently available microcircuits, their characteristics and how well they perform.

Initially, NADC will not conduct integrability tests, but present plans call for the addition of this function later. Avco company an BuWeps' prospective bidder has a capable to receive the NADC microcircuit newsletters, whose first issue is due soon. Integrability should be directed to the attention of Mr. H. R. Martin, EL-96, Naval Air Development Center, Johnsville, Pa.

At present, NADC has approximately 50 different microcircuit types from 30

Microcircuit Terminology

Recent advances in semiconductor technology has improved its versatility, resulting in a wide variety of semiconductor for the several different basic technologies. The term used further is combined by individual corporate trade names. In the absence of an established terminology, Avionics Week has adopted the following and will use it in future articles on the subject:

- **Microelement**, or microcircuitry, a generic term used to describe all types of micro-integrated circuit construction techniques.
- **Discrete-component monolithic microcircuitry** in which the circuit consists predominantly of separate microcircuit active and passive components which have been fabricated prior to their installation on the overall board or substrate. Typical of this type is the Avco/PERA Mono-Module and the P. R. Malloy pilot computer circuitry.
- **Thin-film microcircuitry** in which circuit is fabricated on a non-semiconductor substrate using passive components which are produced by vapor deposition, or other electrochemical processes. Active components may either be discrete or deposited types. Typical of this category are thin-film microcircuits produced by Avco (JAN-Apr. 8), P. R. Malloy, Vaco Manufacturing, Motorola, General Electric, Monolithic-Honeywell and others.
- **Semiconductor monolithic microcircuitry** which is fabricated on a semiconductor substrate using active and passive components predominantly made from one conductive material and which are usually fabricated in integrated components. Typical of the type are the Texas Instruments' "Solid Circuit" and the Fairchild "Monolithic" circuit.
- **Monolithic microcircuit**, a special form of semiconductor microcircuit in which circuit elements are not easily identifiable as individual components. This is typified by devices developed by Westinghouse Electric under Air Force contract



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[An artist's conception
of the electronic "monster"
who devours and thrives
on square footage]

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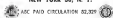


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Aviation Week & Space Technology

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different companies on its test agenda.

To obtain the maximum advantage of microcircuitry, the equipment should be designed from the start with its use in mind. BuWePs has picked several types of equipments to serve as guinea pigs for the development of all-microcircuit hardware.

The current program includes the following:

- **Inertial guidance system**, to be developed by Lorton Industries, is expected to weigh about 40 lbs, including stable platform, digital navigation computer and power supply. This is roughly one-third the weight of present systems having comparable performance. Much of the 40 lb. represents gyros and other mechanical components whose weight is unaffected by the use of microcircuitry. Lorton plans to use semiconductor type microcircuits entirely, and delivery is scheduled for early in 1964.

- **Loran-C receiver**, to be developed by Sperry, is expected to weigh about 20 lb. and occupy only 4 cu. ft. This is roughly a 75% reduction in size and weight over present designs. It will open the way to using Loran-C as a primary navigation aid on smaller aircraft, such as interceptors, according to J. M. Bresler, head of advanced system development for the Avionics Division. When BuWePs drew up its specification for the new equipment, it called for a weight of 30 lb. Sperry came back with a proposal to deliver a 30-lb. prototype in six months, followed 12 months later by a production design weighing only 20 lb., including shock mounts, control box and antenna coupler. Approximately 80% of the microcircuits will be of the semiconductor type, 15% will be thin-film type, with the balance using conventional components in a cordwood-type module, according to present plans.

- **HF single sideband transmitter**, being developed by RCA, will be all solid-state, including transmitter power amplifier which is designed to deliver 400 watts peak envelope power. The set is expected to weigh about 30 lb., roughly 70% less than the functionally equivalent AN/ARC-38A now in use. RCA plans to use mostly thin-film microcircuits and may even employ a voltage-tuned solid-state antenna coupler. RCA will use considerable voice processing circuitry to lower power consumption by minimizing the ratio of peak to average power, Bresler said. Prototype equipment is scheduled for delivery early in 1964, with production models available in mid-1964.

Plans to award a contract for development of an all-microcircuit AN/PRC-49 air-sea rescue beacon have been deferred until FISC 1965 funding becomes available.

The Avionics Division currently is surveying its equipment suppliers to

determine what types of circuit functions, not now available in microcircuit form, they need for future use. BuWePs hopes to complete the survey by the end of the year and publish the results in the NADC newsletter, for the guidance of microcircuit manufacturers.

Microcircuit Specifications

Another current activity is a BuWePs program to draw up microcircuit specifications, covering such things as form factors, test procedures, environmental limits and manufacturing methods. A draft of the proposed specifications for semiconductor microcircuits mounted in a TO can currently be in the hands of microcircuit and equipment manufacturers for their comments. This will be followed by a similar specification

draft for chip-type encapsulated packaging.

Initially, there will be issued as BuWePs' specifications. However, Navy is coordinating its efforts with the Air Force and Army in the hope that the specifications can become full MIL (joint-service) specifications.

Avionics Division officials believe that microcircuits offer an opportunity to reverse the trend of the last decade in which growing equipment complexity has caused a spiral of both initial equipment costs and subsequent maintenance costs.

Lowell and Beasley show a strong preference for semiconductor microcircuits over thin-film types, whenever the former can handle the circuit function. This is based on the belief that complete semiconductor microcircuits



Gunsight Helmet Aids Helicopter Pilot

Gunsight helmet enables helicopter pilot to aim gun turret or guide air-launched missile at ground targets merely by looking at target. Developed by Sperry Gyromec Co., the combination helmet-sight uses bolometer reticle mounted on reticleable view for aiming. In photo, reticle is in focus of pilot's right eye. Movement of pilot's head in azimuth and elevation is picked-off by means of mechanical linkage, magnetic or optical sensors, not shown in photo. Army plan evaluation in July in a helicopter. Helmet was developed by Sperry using company funds.



Highly sophisticated space research instrument.

No ordinary household mouse this He's Perognathus longimembris, the Little Pocket Mouse from the southwest desert.

He drinks no water at all. One of the smallest mammals in the world, he weighs in at only 6 to 10 grams fully grown. And he'll hibernate or estivate at the slightest provocation. He simply goes to sleep when it gets too cold or too hot, or food runs short.

We have big plans for these little animals at Northrop Space Laboratories. Nature could scarcely have designed an instrument more ideally adapted to investigate the long term effects of space radiation and weightlessness.

A box just 6" by 6" by 10" could hold 100 hibernating pocket mice—enough to comprise a reliable sample—and everything needed to keep them alive in space for several weeks. Such a package could be

put into orbit quite easily, left there as long as necessary, and recovered for study with the mice still quietly sleeping.

This is just one of the many projects we have in work at Northrop Space Laboratories. Others cover such fields as plasma and nuclear physics, planetary physics and chemistry, materials and structures research, and space systems engineering as well as the manifold aspects of life support systems for space environments.

We have much to learn about the hazards of prolonged exposure to space conditions before we can afford to risk men on such long term projects as moon exploration or manned space stations. The Little Pocket Mouse may well give us a reliable and inexpensive short cut to much of this knowledge. **NORTHROP**

can be mass-produced to sell for little more than the cost of a single transistor radio.

Savings Anticipated

If this proves to be the case, the overall cost of mission equipment should come down significantly. If the claims of semiconductor science, not manufacturing, that a complete circuit function will be as reliable as a single transistor prove true, there should be important gains in reliability.

Recent trouble-shooting tests go up favorably with the number of individual components in an equipment, the order of magnitude reduction in components resulting from the use of semiconductor instruments should slash maintenance costs, Lowell believes. Avionics Division officials recognize present limitations on travel packages and functions in semiconductor instruments, compared with transistor types. But they expect important advances because of the fact that semi-

conductor technology is 14 years old, and that more than \$100 million already has gone into its research and development, whereas the first film technology is of more recent vintage. However, both DeWitt and the Office of Naval Research are supporting research and development programs in film film technology.

Cd. Lowell acknowledges that equipment designers will have to accept the idea of making wider use of standard circuits than in the past, if the micro-circuit is to develop into a mass production product destined to bring costs down.

He concedes that this may require that DeWitt staff set less rigorous performance specifications for some of its equipment.

But Cd. Lowell says that a Navy pilot would rather have a mission performance ratio set which operates at the time that a more sophisticated model with 10% more range which is seldom operable.

NEW AVIONIC PRODUCTS



19 power contacts in a 3-in. shell. Manufacturer: Motorola, Inc., 210 First Ave., S. Pasadena, Calif.

• **Rate gate, BG 25**, suitable for remote applications. Its two moving parts. Bismec lightweight gate sheet is light & supported gate is used to withstand 10g, a shock design. Heavy-duty solid gate has no symbols. Manufacturer: (Hawthorn), Inc., 1501 Canyon St., San Diego, Calif.

• **Vertical reference rotator, RS 15**, capable of rotating vertically within a 14-in. cone of air flow, with maximum error rates limited to ± 1 mm, can provide

• **Tunable high-power, C-band duplexer**, generates accurate, accurate and high-power transmission to be converted to single antenna antenna without interference, provides high isolation between transmitter and receiver and low loss in desired signal over 4400 to 5000 mc band. Transmitter to receiver attenuation is less than 30 db (insertion loss) and less than 30 db (insertion loss). The power can handle 1 kilowatt CW and provides gain of 1.15 when other losses are terminated in loads with loss of 1.02 or less. Manufacturer: Avionics Systems, Inc., Englewood, Colo.

• **Multi-pin connector with a threaded coupling ring** suited to a threaded receptacle to hold the components together under high vibration. Connectors provide 61 power contacts at 19 contact centers within a 1.6-in.-dia. shell. A smaller version contains up to



correct advance for Doppler multi-high-power aerial sweeping, off-axis rotation and remote test instrumentation. System consists of an auxiliary standard Schuler-based platform. Manufacturer: Avionics Laboratories, Inc., 35-25 46th St., Long Island City 1, N. Y.



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Circle 10 on Reader Service





WESTLAND SRN.2 HOVERCRAFT approaches coast and rock beach at approximately 15 kt, riding on air as evident.

SRN.2 Hovercraft Shows Speed, Maneuverability



THROWING CONSIDERABLE SPRAY to the rear, Westland SRN.2 Hovercraft moves ashore beach at the rate of 10 ft per sec.



HOVERCRAFT, SHOWN RESTING ON THE BEACH, operates on an cushion about 4-6 in. above surface. Cushion is 510 sq ft in size.

Site of Wright-Patterson version of the Westland SRN.2 (hovercraft will weigh about 40 tons) will be moved primarily at civil markets and will have improved rough water capability.

Rafael Martin Jones, Director of Design, chief engineer, and the SRN.2 were at various times built here, but one ship in 3 ft. more with little difficulty. SRN.2 version would operate at rates up to 1 ft., carrying 120 passengers against 50-70 persons for the SRN.2 Hovercraft.

Although fitted with various types with the SRN.2, presently a research vehicle for Hovercraft Development, Ltd., the present version is planned, however, and the SRN.2 has been found to Royal Navy for testing on land-based water. The SRN.2 has traveled more than 1,000 mi. in testing so far. Even the SRN.2 has operated for more than 100 ft. and speed range has been stretched from 25 kt. to 60 kt.

In first public showing at the site of Wright-Patterson facility, the 27-ton SRN.2 moved across a comparatively takes at speeds up to 61 kt. Now level is less than the first period. Blackbird, which goes to sea engine. Rafe still is unable to do much improving light hulls. On test air is supplied by two recorded from mounted in lower center during air intake structure disrupted a plane there. However, chamber allows the vehicle to float on water and to proceed at a boat at speeds up to 6 kt.

F. C. Widdowson, Westland deputy chief and managing director, told Aviation Week & Space Technology, the firm has been ordered for construction operations. U. S. Navy and some commercial operators have shown considerable interest in the vehicle.

Aviation Jones, who said until now for delivery were now being worked out on a production basis, estimated operating costs would be about five cents per passenger mile. He said ticket charges for a 18 mi. trip would be about \$1.50 per passenger. Company has spent about \$1 million of its own money in Westland Development with the objective also a 70-ton vehicle costing \$1.5 million, carrying up to 300 passengers.



PASSENGER DECK from 20 x 30 ft. sides about. Side trailing poles mounted pivoted to offset 20 ft. forward, poles moved up to 30 deg. to facilitate beaching, hovercraft operates in a boat.





Original Sparrow III with F100-2 "Dorian"



Improved Sparrow III with FAI-1 "Phantom II"

Sparrow III- New Weapon or Old?

The Navy aggressively pursues a policy of product improvement of its operational weapon systems. This results in maintaining a lead over enemy capabilities, while minimizing the problems arising from deployment of a new weapon, such as ship outfitting, personnel training, establishing maintenance depots and logistic support, as well as the initial low tactical effectiveness so often experienced.

An excellent example of a weapon improvement program is the Sparrow III, the Navy's all-weather air-to-air missile system. Under the guidance and direction of the Bureau of Naval Weapons, a continuing series of improvements has been evolved.

The missiles pictured above are identical in outward appearance. However, the improved Sparrow III has more range, can be launched at higher speeds against higher speed targets, at greater altitudes.

Raytheon's Missile and Space Division developed and produces the Sparrow III and its associated aircraft equipment, and is the systems integration manager for the Navy on the entire missile system.

RAYTHEON



TAKI TEST at Naval Air Station, Lakehurst, N. J., shows Boeing 720 jet transport rolling down runway just after tail hook in All American Engineering system has engaged arresting cable. Aircraft is used by FAA as arresting system tests.

FAA Pushes Arresting Gear Development

By Arnold Sherman

New York—Federal Aviation Agency is giving increased priority to development of aircraft arresting equipment for commercial airlines and as part of this project has tested 1963 jet the capability of arresting equipment at an East Coast airport set to be designated.

Later last May, FAA requested proposals from contractors to develop and test an arresting gear for commercial jet aircraft.

FAA specified that the arresting system should be of a rotary type consisting of reel, nylon rope, pendant and a suitable energy absorption unit. The system must be capable of decelerating aircraft in the weight category of from 100,000 to 150,000 lb. at engagement speeds ranging from 150 to 170 kt. (Gross weight of the Boeing 707-420 is about 175,000 lb.)

The arresting system must be capable of engaging aircraft at two-nominal intervals, and operational run-out must not exceed 1,000 ft.

U. S. Navy has been asked to assist the agency in the evaluation—arresting units including hooks and harness are standard equipment on aircraft carriers—and a decision is expected shortly.

While civil aircraft equipment is still experimental, the arresting principle has found wide application among the military. In addition to extensive naval utilization, all Air Force overseas bases aircraft are currently equipped with landing hooks. Arresting gear on both has been left for the Navy's Grumman F-14B and an aircraft carrier adaptation has been proposed to Boeing by Douglas (AW July 29, p. 30). Under Navy agreement with strictly Marine applications, highly portable, mobile catapult and arresting gear units have been fitted into Marine's SATS (Short Aircraft Field System) program (AW Jan. 1, p. 74).

Speaking of his agency's arresting gear plans, Administrator Joseph L. Palumbo said: "Our own development of equipment to land aircraft that weigh about 100,000 lb. or more is in fact as much as military gear. For practical use, this equipment must be capable of smooth deceleration rather than the familiar abrupt landing stop of an aircraft carrier landing."

To date, no program has been based on aircraft. The two elements in development are a tail hook for the aircraft and the ground arresting equipment itself. Transport equi-

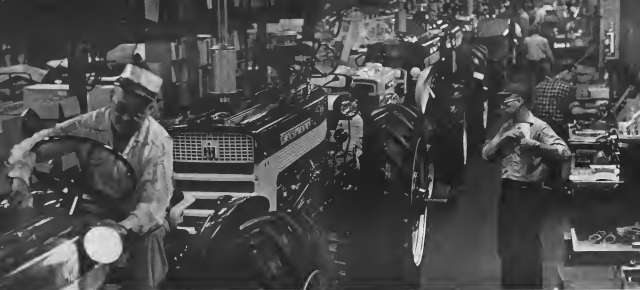
city arresting gear is now in testing at an All American Engineering facility at Georgetown, Del.

Recent test was conducted by All American Engineering with assistance extended to representatives of FAA, the military and industry to observe the experiment. A freight load, moving down a track at 140 mph, was successfully arrested. "This was the 70th successful arrestment of equipment simulating the heaviest transport that we have conducted for the FAA under a continuing development program," Charles W. Wendt, president of All American Engineering, said.

Wendt said that successful arrestment of an FAA Boeing 720 indicates that there is no question but that equipment can handle the required loads at engagement and that the arrested aircraft will sustain no structural damage.

He and FAA is pressing a high priority on arresting equipment and that the agency's latest request for bids is such an indication of an accelerated program in this direction.

The latest FAA bid request, in which civil aircraft, All American Engineering is the leading, is a complement to the program already in effect with that



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■ The computer's unique assignment priority distribution the jobs for all jobs in one second's time and the detailed information.



■ As all jobs in one area are assigned the computer reads the job data in the past week, repeating the process until the line is balanced.

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1000°F 550°K	INDUSTRIAL PROCESS RANGE <i>Infrared Radiometer Pyrometers, Thermocouples</i>
300°F 150°K	BIOLOGICAL RANGE <i>Thermal systems, resistance thermometers, thermocouples</i>
0°F 25°K	ENVIRONMENTAL RANGE <i>Shield thermal systems, metal oxide thermometers, Type T thermocouples</i>
-300°F 100°K	CRYogenic RANGE <i>Resistance thermometers</i>
-400°F 0°K	

Honeywell supplies reliable, accurate, rugged thermometers, filled, both thermal systems, resistance thermometers, thermocouples, and infrared Radiometer Pyrometers to measure temperatures from the very bottom of the temperature scale to just beyond the combustion range of most rocket propellants and propellant combinations.

FOR THE NEW WORLD OF CRYOGENICS Today, extreme coldness, electronics, and some industrial processes are degrading more and more on applied cryogenics. The weakness of resistance of extremely low temperatures in materials testing, superconductivity, research, and many other areas of science and technology has led to the development of a new world of cryogenics. Honeywell has gone to supplying instruments for measuring and controlling extremely low temperatures. Typical of this is the creation of the Honeywell Germanium and Resistance Thermometer, which measures from 1°K to 300°K. Available in probe, surface contact, and shielded mounting models, it provides a relatively strong signal output that can be accurately measured and recorded by means of standard potentiometer units or Honeywell's Electronic IL.

GIVING WARNER, the Environmental Range (-300°F to 0°F) is available from extreme cold, such as that encountered in space simulation, must be accurately measured. Beyond this is the Biological Range, a narrow interval extending roughly from 0°F to 300°F within which ordinary life functions are possible. For both of these ranges,

Honeywell supplies filled bulb thermal systems, resistance thermometers, and thermocouples for very close measurement of temperatures under widely varying conditions.

GOING UP THE SCALE in the practical use and measurement of heat, the Industrial Process Range is needed. This extends roughly from 300°F to 5000°F. Honeywell makes a number of particular types for use in this range: infrared Radiometer Pyrometers and many types of thermocouples, each of which has its own individual measurement range and sphere of usefulness.

TO 7000°F Beyond the Industrial Process Range lies another world which may conveniently be called the Rocket Fuel Combustion Range. In this, temperatures reach up to 7000°F (4144°K). Most rocket propellants and combinations of propellants have combustion temperatures below this figure, which is the upper limit of Honeywell's small target infrared Radiometer Pyrometers.

If you are faced in the measurement of high, low, or intermediate temperatures, Honeywell can undoubtedly be of real help to you. In addition to having the world's most complete line of instruments to make these, Honeywell recognizes the complete responsibility for on-the-instrumentation and related systems. From feasibility studies through installation and continuing maintenance. If you are doing work that involves temperature, maximum, and your nearest Honeywell Branch Office. Main offices: Honeywell, Wayne and Windsor, Pennsylvania 66, Pa. In Canada, Honeywell Controls, Ltd., Toronto 15, Ontario.

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First in Control

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company. The intention of the agency is to develop an end-different type of aviation equipment, have that centered in quickly as possible, thereby putting this equipment on the market for maximum use.

According to FAA sources, All American's current contract to develop a water-cooled turbojet engine unit in which a plunger is forced in parallel branches filled with water and a activated against the water when the aircraft's load engages the engine, has been extended until Nov. 15. The contract has been modified to include weights in the 300,000-lb. range and maximum air speeds of 90, 160, and 120 ft.

The agency has added \$405,000 to the current contract making FAA's total commitment to All American \$764,000.

All American is the company designated to install the East Coast airport equipment installation this year.

Blue Equipment

Another highlight in the jet-propelled gas competition is the E. W. Blue Co.'s Launch and Recovery Equipment Division with manufacturing facilities at Daniel Hill, Pa.

Manager of the division, Robert W. Clegg, told Aviation Week that Blue had sent the FAA a proposal last fall for an interim commercial airport gas capable of engaging an aircraft the size of the Boeing 720. Clegg said that FAA reported that proposal be sent the agency was examining equipment proposals which could go beyond that weight limitation.

Blue says that its agreement last fall had two problems: inability to build a commercial airport solely the airport must be able to stop an aircraft safely enough so that neither the plane nor its passengers will become injury, and the cost must be capable of being an amount that engages the airline of cost.

Military Success

Clegg said that in a week of combat military success with the equipment, Air Force is considering use of existing equipment at present approaches instead of merely an emergency measure at the end of the runway.

Blue's latest catch to date has been with a 71,000-lb. Douglas A-1H traveling at 105 ft.

Accident prevention equipment proposals entered beyond the United States. Falk Nordrup, head of Sweden's research-and-development program Refu to defense said that a steel wire net barrier at the end of a civilian airport runway would prevent many transport aircraft crashes. Navy said that aircraft barriers are now standard

equipment at all NATO air aircraft fields and that the U. S. Navy, working out of its Lahaina, N. I., test facility, had demonstrated a 27 aircraft tests that heavy commercial transport gas aircraft could be safely stopped even after the aircraft speed has been reached.

The Refu test, which according to Nordrup can be used in less than two seconds, consists of two vertical poles connected with two horizontal steel bars holding a net of nylon cord.


Accelerating Systems

As a corollary of existing gas manufacturing industry production of the equipment have led to develop dual

load accelerating systems in order to test their existing equipment. Although All American Engineering said that limited dual load tests outlined with 4-5000-lb. test and each weighing 100,000 lb. for the General Motors, the company's Turbo-Jet launchers, equipped with an Allison J33-A16A jet engine, and being used as a Navy launcher is used in conjunction with heavy weight tests.

Blue has developed a combination launching and recovering device using the rate-of-rise principle, called a "Catcher."

The Blue system currently is being checked for short runs in forward landing areas.



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THE PRACTICAL MEN

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For now the aerospace industry is called upon to engineer space ships that will travel thousands of miles from earth and return. It is called upon to develop rocket engines with the power of a million automobiles. It is called upon to produce electronic equipment that will last thousands of hours... to design antenna systems that can listen to stars billions of miles away... to produce electricity by nuclear power with increasing efficiency.

Even while you are reading this, the engineers of the aerospace industry are working toward these objectives. They are creating functional ideas from broad theories. They are searching out the exact materials, equipment, systems, and components to suit their needs. Often in this search they must create their own answers.

Steadily, piece by piece, part by part, the finished whole begins to emerge. The prototypes are examined. Tests run. And finally the new system is complete—tested, proved, ready to use.

This is the work of men who turn ideas into reality. This is the work of men who are creating the products of tomorrow and the industries of the future.

This is the work of the practical men.

North American Aviation is at work in the fields of the future through these six divisions: Atlantic International, Automation, Columbus, Los Angeles, Rocketdyne, Space & Information Systems.

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Lockheed Team Backs Lunar Rendezvous

By Russell Hawkes

Los Angeles—Feasibility of a safe, unpowered mission orbit during the lunar landing phase was one example of greater operational flexibility claimed by lunar orbit rendezvous mission profiles in manned trips to the moon by R. A. Zucrow and A. E. McCool of Lockheed Martin & Space Co. at the national seminar meeting of the last week of the Aerospace Sciences.

Technical studies on lunar exploration programs also have a diversity of one-way powered missions in which one or more astronauts might land on the moon without a return vehicle, and a description of pioneering orbital vehicle developments for transportation on the lunar surface.

Advantage of lunar rendezvous for extended landing missions listed by Zucrow and McCool included:

- Wide choice of landing sites and opportunity to conduct reconnaissance of possible landing sites from the relatively close vantage point of the lunar orbit.
- Chance to make any necessary repairs before being committed to a lunar landing.
- Reduced propulsion requirements because the mass of the spin-stabilized lunar landing vehicle could be less than half that of a vehicle required to carry propellant and vehicles for the return trip to earth after the lunar landing.
- Design of landing vehicle is not constrained by requirements for station

phase re-entry or for long occupancy but can be ignored for the one purpose of landing on the moon's surface.

• Earth return vehicle is not exposed to the hazards of the lunar landing.

Mission Complications

The only disadvantage cited by the authors was the greater complication of the mission required by the lunar orbit. Lunar orbit must be inserted not only on the basis of the earth moon trajectory and the chosen landing site but also provide a suitable ascent trajectory from the lunar surface to the rendezvous orbit and a suitable earth return trajectory. Propulsion and guidance requirements are more demanding if the launch site on the surface of the moon is out of the plane of the moon's orbit.

For two times of more than a week, the effects of plane change on these requirements can impose significant penalties if orbit insertion is not optimum.

Landing maneuvers can be designed so that if trouble develops early in the descent from the lunar orbit, a powered abort maneuver can be made to return the spacecraft to the rendezvous orbit. The unpowered landing procedure involves two operating periods for the propulsion system of the lunar lander. First is a downward thrust to shift the orbit of the vehicle so that a periscope (pointed toward the moon) at 10 mi. will be visible 94-1 day, around the moon from the insertion point of the maneuver. The second produces a horizontal retrograde thrust at periscope to

close the vehicle from orbital velocity and the thrust is rotated upward to decelerate the vertical velocity component in the descent from orbit.

Until the application of retropropulsion at the beginning of the final landing approach, the lunar lander is in an orbit which intersects that of the earth system spacecraft and has the same period. It is this which makes possible an unpowered ascent if trouble occurs on the descent trajectory or if ignition fails on the second burn. The two spacecraft will come together again after orbital period after the first engine run and the rendezvous can be completed with an other short engine run with thrust oriented in the opposite direction to align the two orbits.

Altitude of the rendezvous orbit should be high enough to permit line-of-sight contact between the spacecraft and the landing point for a long enough period of time to solve the guidance problems and coordinate the different phases of the mission.

Lockheed Team

Lockheed study team outlined the possible design of a two-man lunar lander for operations from a lunar ascent vehicle. They estimate that one man could probably handle the mission, but with two, there is a reserve crew member to deal with emergencies and the weight penalty for carrying the extra man is only about 800 lb. under lunar gravity. At least one man would remain in the earth return spacecraft to



Boeing 377 Converted to Carry Saturn C-1

Boeing 377 Stratocruiser is being modified by Du Pont Engineering Co., Van Nuys, Calif., to carry stages of Saturn C-1 space vehicles. Latest work includes fitting bellows structure to support boosters and lengthening aircraft by adding 12 ft. section from another Boeing 377. Work is being financed by a joint venture by Aero Spacelines, Van Nuys.

Au = RELIABILITY Ni

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Gold over nickel plating... the standard AMP choice for printed circuit connector contact! Not optional... but standard! And with good reason...

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needed. There are no pre-loaded, unused contacts! Orma, scrapie type contacts are plated with 000030" gold over 000030" nickel (min). There is no metal "creep". No debilitating oxide insulation buildup. Contact pressures are engineered to avoid excessive or quick plating wear. Consequently, AMP-Inert connectors last longer, pay maximum performance and assured reliability.

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and part of the AMP-Inert line. Connectors and General Catalogs.



AMP LEAF



AMP ELITE

AMP products and engineering assistance are available through subsidiary companies in Australia, Canada, England, France, Germany, Italy, Japan, Mexico, West Germany.

Proprietary AMP technology

maintain it and observe the laser levels.

Though propellant would be carried by the laser laser to permit selection of a loading site within a 100 mi. wide swathe range along the orbital path. Minimum out of phase distance would require a 600 tps. Earth laser vehicle movement compared with 400 tps. needed for an impulse device. The final loading requires a final laser phase and enough propellant would be carried to supply thrust equal to the laser weight of the vehicle for two minutes. Control of vertical thrust would be obtained by varying the cost of the engine to maintain vertical thrust component between zero and 2.5 times the laser weight of the vehicle. The velocity increment needed for the laser launch with a slight change in the orbit plane is 5,500 tps. plus another 500 tps. for the final rendezvous and docking.

Crew Position

The booster crew could be face-downward and foot-to-the in the vehicle to get a good view of the loading area. The prime position allows them to tolerate high accelerations during loading.

Minimum acceleration during launch is 1g (earth equivalent). The crew compartment would be the major structural component on which propellant tanks, engines, antennas, and other equipment would be mounted. The main propellant area would be main pressure-fed, electric hydraulic propellant and must be capable of four starts in a normal mission. Final loading and rendezvous maneuvering are done with only two of the six engines mounted on the sides of the crew compartment. Forward solid orb in the descent trajectory can be accomplished with several engines out, but all other maneuvers require six engines.

By using a vehicle such as earth reentry capability, U.S. could begin manned exploration as much as two years earlier than Project Apollo, according to John M. Cost and Leonard M. Sade of Bell Aerospace Co.

Reason for the earlier mission dates for a spaceway mission is that early escape period for such a mission would be only about 6,000 lb. to 5,000 lb. compared with between 17,000 lb. and 20,000 lb. for a conventional mission, assuming equal laser gravities of 2,500 lb. The range of booster thrust requirements for each type of mission could be from 450,000 lb. to 1.1 million lb. for the one-way mission and from 1.1 million lb. to 3.5 million lb. for the two-way mission. The smaller boosters could be available from 1.5 to two years earlier than the larger ones.

Lunar loader for the moon mission would carry one man and food water and use a 12-day mission plus an 18-day emergency air supply. The 12-day

mission would depend upon supplies from automated lunar cargo spacecraft reaching carrying a 910 lb. payload, which could be loaded on advance of the mooned mission. An early automated lunar rover could carry a landing beacon to ensure that the cargo spacecraft all land close together to make it feasible for the astronaut to walk and use the supplies in the cargo vehicles.

Control of the moon surface transportation vehicles will be complicated by the fact that gravitational screening from during a turn will be the same as they would be on earth, while the stabilizing force of gravity will be only one-sixth of that on earth. Thus a 3,500-lb. vehicle will need a 16-ft. wheel base to prevent it from tilting over on a 2-ft. radius turn of 30 mph. Major bumps will also be gone of a kind that then are to surface transportation in earth. A 1,000-lb. vehicle hitting a bump about 18 in. high can be expected to fly 30 ft. before hitting the surface again. These points were mentioned by Edward G. Marlowe of Grumman Aircraft Engineering Corp. in a report on metal elastic wheel work on the problem of lunar surface transportation.

Elastic Wheel

Grumman has outlined the experimental design which is an attempt to combine the advantages of the tank track with the simplicity of a rigid wheel. In comparative tests with a rigid wheel of the same diameter, the elastic wheel proved to have 20% less rolling resistance, 40% better shocker pull (useful thrust) and a significant advantage in obstacle climbing performance. The metal elastic wheel will be used during the lunar demonstration then it would be on earth because the fatigue life of metal increases by factors of four to 10 to 50 in a vacuum.

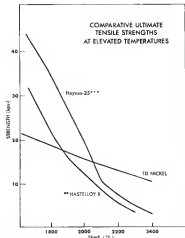
Wheel stresses of elastic spokes are reduced because from a metal hub is a elastic rim. Under vertical load and driving torque the wheel assumes an elliptical shape. When a smooth elastic wheel and a smooth rigid wheel were tested the elastic wheel was found to have one-fourth the rolling resistance of the rigid wheel and the difference increased as vertical load increased. Apparently this is because the elliptical distortion of the elastic wheel in side load is increased because the length of its footprint to increase so that one pressure on the ground means nearly constant through a three-to-one range of vertical loads. Traction of the two material wheels was the same. It was governed only by weight times a friction coefficient.



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TENSILE STRENGTH of TD Nickel compares that of the modified super alloys at about 1,500°F. On first glance, comparable strength of current super alloys decreases sharply when the temperature runs above 1,700°F.

Toughening Technique May Reduce Need for Re-entry Heat Shields

Baltimore—Higher, faster-to-weight ratio gas turbine, gas turbine, gas turbine, the ability to withstand the heat of re-atmosphere re-entry, are expected to be sold from a new Post Co. technique for toughening metals such as nickel, titanium and tungsten.

The patented process involves designing gas turbines of a stable oxide uniformly within the grain structure of a metal. It is a simple way to produce TD (Thermally Diffused) Nickel which is Post's alloy in superalloy in the 1,800 to 2,400°F temperature range to the so-called super alloys. These patented, exceedingly expensive alloys are used in high heat situations where strength is imperative. These super alloys

last at about 1,500°F, and all are either nickel or cobalt based.

Common superalloys, such as General Electric's CMCs, operate at temperatures as high as 1,700°F. Dr. Post is proceeding on the theory that titanium would weigh prefer but not temperatures of about 2,500°F, then to gas "save power per pound of engine weight, which means more speed for the same load or more load for the same speed," Henry F. Peters, research manager for metal products and.

Dr. Post looks to TD Nickel as the first of a family of metals that will offer not only greater strength at these higher temperatures, but also heightened resistance to oxidation and corrosion, and

improved stability. Some of the advantages claimed for TD Nickel are:

- There is fourfold increase in the high temperature strength of pure nickel. The consolidated metal runs out at 2,500 to 2,600°F on temperatures in the 1,600 to 2,400°F range.
- No loss of strength despite oxidation to within 10% of its melting point. When a super alloy is oxidized it is "strengthened." It usually loses half of its original strength.
- Ability to withstand, for periods in excess of 100 hr., greater stresses than the super alloys when both are heated to 1,800°F. In addition, maximum rate of TD Nickel at five temperatures—1,800 to 2,400°F—is almost as good as the best nickel alloys and far better than pure nickel.
- Ease to fabricate at room temperatures. According to Dr. Post, many of the most advanced super alloys can be worked only in cast form because of prior properties at room temperature. TD Nickel also retains 95% of the thermal conductivities of pure nickel.
- Because of these qualities, Dr. Post believes TD Nickel may become a key component in the tubing associated with liquid rocket engines. In the aerospace area, where they demand such as carbon steel operate steadily at high temperatures, the company believes TD Nickel offers greater stability and longer life. TD Nickel's special application in the jet engine field probably will center on gas turbine, turbine blades and turbine case. It may offer a role in reducing need for heat shielding on re-entry vehicles. Tests are under way in all these areas. Post & Whitney and General Electric are studying the alloy. The former specifically referred to it as the "gold," but a spokesman for GE, William W. Wren, it looked promising even though the company had not yet made any decision on applications.

TD Nickel was made in a single unit in form of varying diameters and tubes will be produced later. Current price is \$10 per pound. The cost should decrease with volume production, and Dr. Post says TD Nickel will become competitive with the super alloys which will cost less than \$10 per pound.

Thermostatic, TD Nickel's handling agent, is a mixture of two fluids under the regulatory authority of the Atomic Energy Commission. A specific license must be obtained by persons who intend to use or transfer more than 3,500 lb. per year of the alloy.

Formerly, by a technique known as precipitation hardening, metallurgists reacted small, hard particles between and within the grain structure.

Dr. Post's technique, which is described as a heat-treating, involves dissolving these hard particles—about a millionth of an inch in diameter—by chemical means of mechanical means.

Believing the annual Walter Wright Memorial Lecture to the Royal Aeronautical Society, Pearson offered the following:

- **Establishment of an advisory Ministry**—an advisory committee to work closely with the Ministry of Aviation.
- **Reorganization of the British government's policy of creating** a new set of engines developed with government support, a policy that previously has been strongly opposed by Pearson and other industry executives (AW May 25, p. 278).

Industry has some time has been attempting to convert the Ministry of Aviation's policy of creating a new set of engines developed with government support, a policy that previously has been strongly opposed by Pearson and other industry executives (AW May 25, p. 278).

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MANAGEMENT

Rolls Official Attacks Government Levies

By Herbert J. Coleman

London—British aero engine industry is in immediate need of reviving of liaison between itself and the British government to improve relationships and handle the problems of future research and development policy, J. D. Pearson, deputy chairman and chief executive of Rolls-Royce, said here recently.

Delivering the annual Walter Wright Memorial Lecture to the Royal Aeronautical Society, Pearson offered the following:

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we would only be following the practice of other industries and other countries and it seems to me odd, in an industry where such a commitment is badly needed, that it has not so far been brought to life.

Royalty System

Referring to the British system of royalty payments, Pearson mentioned a negative government support of the civil version of the Rolls-Royce Avon jet engine, on which royalty was paid on commercial sales. But, Pearson pointed out:

"Unfortunately, that system of royalty payments was also being applied to the sale of engines which were developed by the government for purely military requirements. That has put Rolls-Royce in the effect of doing away from the industry money which was badly needed to pay for civil engine development to sustain it in the future."

He stated that in the period of 1954 to 1958, during which government policies on support were being reviewed, civil engine development cost Rolls-Royce about \$180 million and when other costs were considered, total as against some \$110 million. Because of this, he said, it was clear that

British Unions

London—London of the two most powerful unions in the British aircraft industry have attacked government policies as resulting in a situation where the state status of the British aircraft industry is in peril.

Comments came from Chris Jenkins, general secretary of the Assn. of Supervisory Staff, Engineers and Technicians, and George Douglas, general secretary of the Engineering and Aircraft Technicians Assn. In a joint statement, they said:

"The threatened closure of the Short Bros & Holman factories in Belfast (AW June 25, p. 27) is one more sign that the government's policy of subsidizing the aircraft industry now seems fully thought out, we seriously applied and has resulted in a situation where the fate of the British aircraft industry is in peril. It is clear to us that the government has no plan for dealing with the rapidly declining rates."

Both men called for a conference of Commonwealth officials, manufacturers and service members to plan the British aviation efforts in the 1970s.

there should be a careful assessment of ratio of funds invested by the company and money spent by the government to keep the firm from a competitive disadvantage.

Pearson contended that British royalties can only be considered as a cost estimate, with the absence of such a result in the U.S. and France, the major competitors for aero engines, by coming in export subsidy.

In another line of government support, Pearson said, the development of the second generation of bypass engines, in which bypass flow is high, was in jeopardy because of the government's attitude.

"Despite the foregoing risks involved, Rolls-Royce decided to go ahead at its own expense with the development of these engines, exemplified by the Meadows RB141 and the Spey, confident that they were the right policy."

"Since that time, the British government has come forward with proposals for sharing development costs on future engines. However, the Meadows is still without any form of government support and money drained off from fees which would be an aggressive policy of private venture development is still allowing their financial collapse and their ability to tackle future projects."

The Meadows is a family of engines including the RB141, the RB174 and the RB177, all in the 15,000 lb. thrust class. It originally was specified for the de Havilland Trident derivative transport and when the airline's specifications changed, the Meadows became, in effect, the Spey. Meadows engines achieved considerable technical ratings time with data for Spey development, but the engines are no longer in being run, since production is concentrated on the Spey line.

Turning to the future of the British aero engine business, Pearson contended that "on the military side we are in the hands of the politicians but, even if private development took place, I believe that the need for international pooling would still call for very large numbers of military orders, although the majority of these might be transfers."

Concerning Rolls-Royce sports and recreational business, Pearson said, "We are working very hard in this regard, and at considerable expense, to put ourselves out of business." He referred to the 3,900-hp. 16 in. Duct Turbo-prop engine and high bypass turbofan engines of up to 15,000 hp. as examples and predicted that sales side of the business

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E-200 HIGH TEMPERATURE CAPACITORS Operable to +200°C.

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would be a defining proportion of the whole.

Pease also contended that, in general, irreversible technical developments such as a supersonic transport (for which Rolls-Royce has an engine in the design stage) and vertical lift are not likely to have any major effect on the development of the engine industry in the West, except to "push it on a collision course into a smaller number of larger units based on international groupings."

The industry must be conscious of the stage it is reaching in the basic development cycle of its product and concentrate increasingly on improving the efficiency of its designs from the point of view of production and over-

all economies rather than the search for technical efficiency alone.

Pease considers the most significant development of the past year is the manner in which the industry has integrated its national status through a complex series of international and intercompany agreements.

As for the optimum number of aero engine companies needed in the West, Pease said all industries are that a relatively small number of firms should be capable of sustaining adequate competition and to compete with Soviet products, "provided we can come to a tight relationship with our own government so that they are able to see that we do not allow ourselves to be out-manned."

FINANCIAL

Airlines Report Officers' Salaries, Other Compensations During 1961

Washington—New York, American Airlines, Eastern Airlines and Capital City Helicopter Airlines recently reported the following salaries, expenses and other compensations for their officers and personnel in operating lines to the Civil Aeronautics Board last. Reports covered the year ended Dec. 31, 1961, and included:

New York American—**W. H. P. P. P.**, president and chief executive officer, \$1,000,000 salary, \$100,000 expense, \$100,000 bonus, \$100,000 other compensation, \$100,000 total compensation.

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After recent tests conducted by the Air Force and the Aerospace Division of General Dynamics, the Dage RGS-10 system was chosen for Air Force weapon system support for the following reasons:

- Camera is certified to contain an internal explosion of 150/115 octane aviation gasoline. (Shaperson report per MS, E-32228-Proc. 9)
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- One year warranty.

There are now more than two hundred Dage RGS-10 systems being delivered for use in activation and as support at every operational Air Force base across the nation. Here are a few other applications of Dage television systems:

Observation of aggressive materials
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Patrick Air Force Base—Florida
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Port Arthur—California
Rocket engine test observation
Red Stone Arsenal—Alabama

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NASG—Wallops Island, Virginia
Reentry observation
Hurler—Washington
Eyes for remote controlled tank
Fort Belvoir—Virginia
Air-to-air refueling observation
Dennis Naval Air Station—Virginia

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The Dage Division of Thompson Ramo Wooldridge provides a complete range of cameras, cameras, accessories and other equipment as well as systems engineering and field installation and maintenance service. If you would like to learn more about the Dage RGS-10 or other Dage television systems and development capabilities . . .

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The new Para-Visual Director (P.V.D.) controls and permits to the pilot, on an entirely new way, information previously available only on his instrument panel. It consists of small "bread-b" panels, which are also called the runway picture, look-up panel. These are usually visible even out of the corner of the eye. The pilot has access to constant information which enables him to maintain continuous correction of the aircraft's attitude without sightseeing, for instance from the runway. The P.V.D. normally being a standard 10 x 10 in. unit with various and accessories. Some parts of the complete system Para-Visual Director are attached to the B.C.B. or the Pilot's Instrument. The full command system is a specially designed for alternative form.

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0916. The flight to the New York City was normal. At approximately 1300 New York Air Route Traffic Control Center was contacted by Flight 526. The Center advised "United 526, New York Center, Roger have your progress, after arrival we will advise, descend to and maintain flight level 250 feet." Flight 526 reported losing flight level 270 at approximately 1814. At approximately 1818 New York Center advised "United 526, clearance lost at 1818. Intercom on 121.60 Victor to Alameda direct to Alameda via Victor 121.60 maintain flight level 250." Flight 526 acknowledged.

At approximately 1823, United 526 called ABING (Abington) Radio, in reported operation of United Air Lines aeronautical communications system and reported "No 2 navigation receiver airborne not operative." The transmission was acknowledged by ABING and relayed to United Air Lines.

At approximately 1821, New York Center issued further clearance to descend to 13,000 ft. United 526 replied "We're either held again."

Subsequent to the transmission the United flight was re-instructed to change to 121.60 frequency, the frequency of another radio receiver on board. At approximately 1822.41 the Center called Flight 526 "United 526 New York Center, radio correct." United 526 replied "Roger, we're cleared to 13,000 ft maintain 23,000 until we first receive from you, is it going to have a delay we could either hold position down. We're going to send E at a rate do you have the weather handy?" The Center replied, "No, but I'll get it, there have been no delay and can." At approximately 1825.50, United 526 reported over Alameda at flight level 230.

The Center acknowledged. At 1829.37 the Center advised that the flight level number was "1,500 ft maintain 1 mile light two leg Alameda setting 2945." Should the flight still be starting down." At approximately 1829.49 the Center advised the ATC clearance as follows: "526 cleared to proceed on Victor 36 until intercepting Victor 121 and then up to Alameda 121.60 is a 1000-1000." (The new station directed the clearance to the Alameda frequency by approximately 1831.11) This was acknowledged at 1831.30. At approximately 1838.49 the flight was cleared to descend to and maintain 13,000 ft. The clearance was relayed at 1839.01 and the flight reported losing 13,000 ft at 1839.16. "121.60 show you remaining constant Victor 36 at the time." United 526 confirmed that it was established on Victor 36 and reported loss of contact with Victor 121. At approximately 1839.40 the Center said "I show you 13,000 ft at 1839.40. Victor 121.60 526 acknowledged and then the Center advised flight level number and then the flight was cleared to maintain 13,000 ft. The flight was cleared to maintain 13,000 ft. The flight was cleared to maintain 13,000 ft.

At approximately 1839.07, United 526 was cleared to "descend to and maintain 13,000 ft." This was acknowledged at 1839.40. The flight reported losing 13,000 ft. The Center then said, "Look, the pilot is able to make contact at 15,000." The answer was that they would try. At approximately 1832.16 the Center stated "United 526, if

holding is necessary at Princeton, southwest on route pattern night time is the only delay will be in descent." The flight replied "Roger no delay we're out of area." At approximately 1837.01 the flight reported losing 13,000 ft. At approximately 1837.40, the Center said "121.60, the way I keep 100 up, was that you speaking lower 6,000 for 5,000?" The flight replied "Affirmative." The Center at approximately 1838.26 advised "526, Roger and you received the holding instructions at Princeton, radio correct." The flight acknowledged. "Good day" at approximately 1839.21. It is accordance with the terms of the Trans-Canada United States Skies Manual

of Radio Air Traffic Control Procedures, paragraph 1.1, the responsibility of the controller is defined as follows: "A minimum of three miles separation shall be maintained between aircraft being controlled in accordance with the procedures authorized in the Standard and between such radio-controlled aircraft and other traffic being controlled in accordance with the Instrument Flight Rules rules standard two-mile separation is provided." The use of responsibility is recommended by other provisions of the same paragraph as follows: "As traffic control is not responsible for deviations from these standards which result from the failure of the pilot to respond to the instructions issued to control them."

With respect to the agreement afforded



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General Electric's 357 turbojet engine is designed to fly about 2000 miles an hour at altitudes between 80,000 and 70,000 feet. This is the Afterburner Spray Jet manufactured by Delavan for use on the F-105.

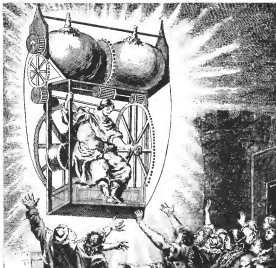
Delavan's 18 years of experience have produced a multitude of fuel nozzles and afterburner spray jets for America's leading aircraft engine manufacturers. This experience

extends to both the design and the large scale manufacture of functional, reliable fuel delivery and metering devices.

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It looked good on paper, but...

...this air machine of 1775—in which the aviator turns a wheel to generate electrical power—was doomed to failure.

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266 and apparently properly mounted. The aviator observed a target approaching from the southeast and informed TWA 266 of the target information on two occasions.

The Weather

A summary of flight reports from 11 aircraft which had operated within a 10 mile radius of the accident site within one hour of the time of the accident shows that 45 flights were in clouds at altitudes ranging from 100 ft. to 10,000 ft. One pilot reported no top of clouds at 10,000 ft. Four of the five remaining reports indicated some ground contact up to altitudes ranging from 1,000 to 5,000 ft. One pilot reported between 1,000 to 4,000 to 1,000 ft. and from 1,000 to 10,000 ft.

Flight Recorder Readout

The White King Flight Recorder aboard the United DC-8 was read out under the supervision of the Civil Aeronautics Board. The government recorded, relating to an elapsed time base, air altitude, winged heading, and vertical acceleration. Some degree of bar and wind speed data was present although the bar part of the record was covered with products of combustion and chemical reaction.

All measurements along the length of the tape (30 in.) had been made with respect to a hole corresponding in time to just prior to takeoff in Chicago. The average distance between the elapsed hole was determined from measurements of the length composed of 36 holes. One indicator of length along the tape is equal to 0.145 in. of a scale of time. This factor was used in computing the time for all events.

The data obtained relative to altitudes indicated accurate and readings are 200 feet in the measurement of flight. The flight recorder shows between 71 and 80 feet below the true of collision as plotted on a track profile on the map. The track was plotted in error from the point of collision determined by a later study of the DC-8 No. 4 engine and the TWA Constellation No. 3 engine.

The engine over-detailed in flight over collision and reported on United Island Analysis of the tape of DC-8 engine indicated a fall of 5,175 ft. on a course of 500 deg. compass. Analysis of the Constellation No. 3 engine indicated a 1,470 ft. fall on an estimated course of between 110 deg. to 130 deg. magnetic. The amount of the two engines determined the collision area of approximately 1,000 sq. ft. the center of which is located on a 115 deg. magnetic bearing 6,551 ft. from the corner of Miller Field.

The altitude at the point of collision was computed to be 5,175 to 1,470 ft. above mean sea level in could be indicated by an altimeter setting of 29.61 in. at Chicago. The indicated altitude of the DC-8 at the point of collision was 100 ft. This was the lowest altimeter adjustment to permit altitudes. Knowledge of the elapsed time of flight 126 from "white" in Chicago in collision was 52 sec. 0 sec. United time of which off at Q River August was 0911. Adding the elapsed time of 52 sec., 0 sec., the time

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stitution Week welcomes the sponsors and its readers on the stages ruled by the game's cultural values. Addressing us to the Editor, *American Week*, 10 W. 42nd St., New York 36 N. Y., is a long letter under 500 words and is a genuine identification. We will print anonymous letters, but cannot publish with an author's real name.

Congratulations on your editorial "New Horizons for Aircraft." It is encouraging to know that such a knowledgeable observer and spokesman continues to champion development of new aircraft for both civil and

James R. McDermott
Vice President and General Manager
Aircraft Division
Douglas Aircraft Company, Inc.
Long Beach, Calif.

President
The Seaman Corp.
Berkeley, Calif.

Your needs may be interested in the vast disappearance of birds in Cape Canaveral which, while not wholly unreported has little scientific support as to where the birds have gone. Only a few hairy noddies, Coots and Loons are left, though numbers of the legendary Tailed Petrel drop by as there was no Niles from the District of Columbia. Bird counts on the eastern coastline during the spring and autumn of the year when compared with bird counts of previous seasons, will probably show the loss. Inhabitants of the decorated beach have chosen.

Some commentators are understandable indignant at being denied admission to being nice, or, growing indignant, at being relieved of their sensibilities. They have had to do poorly on another dimension of such an exercise as the Warped Date Link, the Crazier Red, and the Unabridged List.

To an anthropologist, getting his teeth as he tries to identify these body from remains, date, a simple site (approximately) is a Soviet Russia.

Quezon Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Quezon Week, 320 W. 42nd St., New York 36 N. Y. Try to keep letters under 300 words and give a daytime identification. We will not print anonymous letters, but names of writers will be withheld on request.

Yonahberg's only other birds that he circled are:

- The last model is a sub-system of the well known Kelly-Moser-Harrison-Watson-Harrison

Vice President
 Fletcher Richards, Collins & Hadden, Inc.
 Los Angeles, Calif.

1-year article Fuel Cell Development
Pushed to Space (AS, Apr. 9 p. 54) was
entirely incorrect. The fuel cell seems
to have immediate possibilities, aside from
its space applications. Space is well at
least, other countries, unless for lack of
hydrodynamic power. Might we expect the
fuel to come where you can live in
cruiser area (based on chemical trans-
mission time) and be supplied with a
small power package to operate the electrical
equipment? What a boon to sail cities
and more!

Peter J. Thompson, reporting on this interesting new dimension to power efficiency, I believe prospective customers would be interested in knowing how well certain engines put power output and on, in relation

PETER J. THOMPSON
Stafford, Spots

The standard fuel capacity of the aircraft for all versions is 581 U.S. gal. stored exclusively in integral wing tanks and 70 gal. tip tanks. Fuel consumption and storage capability of the B-90 are limited below.

Economy cruising speed for maximum displacement	
Sea level	1.79 m/70.5 gal
20,000 ft	2.90 m/70.5 gal
Economy cruising speed for maximum displacement	
Sea level	1.79 m/70.5 gal
20,000 ft	3.10 m/70.5 gal

With means for detuning to amounts of 10% that are holding for 45 min at cruising speed consumption rate and 5% of actual consumption.

Cracking at maximum reboiling rate at 21,000 ft. high bed tanks (500 US gal) — 1,970 atm. in.

Don Parnell
President
Tulco Flight, Inc.
Chicago, Ill.

Your editorial of June 11 brings needed attention to the problems of reliability in equity. A hard struggle in philosophy is also usually necessary to avoid further harassment by those of so-called minor com-

In my professional contacts in the glass field I've found that the glassmen who are usually handled by extremely capable people. After the energy is established, the system breaks, and the computer makes condensed answers, the remaining creative work is too often regarded as just mechanical engineering. Perhaps, because the discipline is large & is considered sufficiently taxing the social-oriented electric personnel discuss understanding that making things which become successful is merely an art.

be any in the quality of performance depends largely on the skill and experience of the user. What do we expect from "electro-mechanical packaging support with at least two years experience, degree preferred." ¹ *unclassified*

It says, "and the bakery will be busy as people will really possess the cardinal skills to design, develop, and manufacture these items. But with the pace of failure so high, can we afford otherwise?"

Just Mowbray
Lowry, Calif

I would appreciate it if you would please let my friends in Vietnam know that I am not the Allen V. Butler worth what is now the head of Evolution studies with the General Mammal Defense

Normally, the students, in many, would not be bothered. However, in an

Good luck to the other "M" and thank
you
MAGNUS C. HERRINGDAHL
Woodland Hills, Calif.

Initial Confusion

In an early 2005 issue of *ENR*, you published a very interesting article by Gail Browne entitled "Tajmahal Coastal Fronts to SAS Rowboat." In the course of this article, Mr. Browne mentions the agreement between SAS and The Airways International and refers to the source as

I want to mention the fact that only one compare is known as TAI, and that using web marks for another corner makes good

W. H. CLEGG

Public Relations Manager
Company of Transport Services
Indochina



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Breaking the bottleneck in the sky

Problem: To get more airplanes through the same traffic bottleneck with greater safety. Air traffic has grown so much that long-established, conventional methods for handling it result in frequent flight delays at busy air terminals.

To help air traffic controllers break this bottleneck, the GSN-11 Air Traffic Control System has been developed. A computer-directed system, built for the U.S. Air Force by Avco, the GSN-11 assigns each airplane—jet transport or single-engine craft—its own position and path as it approaches within 90 miles of an air terminal... and directs the aircraft safely and precisely toward the end of the runway for a landing. Thus, busy air traffic controllers are freed from much demanding detail so they can give undivided attention to monitoring the total traffic picture and to emergency situations.

Outstanding features of the GSN-11: Delivers up to 120 aircraft per hour to a landing position, even under instrument conditions; handles 24 aircraft at a time in the terminal area and can operate to three airports simultaneously; provides continuous surveillance of every airplane in its 90-mile control radius; works with any aircraft equipped with two-way radio.

Now at the National Aviation Facilities Experimental Center near Atlantic City, the GSN-11 is being tested with a variety of air traffic situations. Completion of these tests by the USAF and the FAA will enable Avco to offer the most advanced air traffic control system in existence today.

Write: Electronics and Ordnance Division, Avco Corporation, Cincinnati 41, Ohio.

Part of Avco's computer-directed Air Traffic Control Central, AN/GSN-11



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